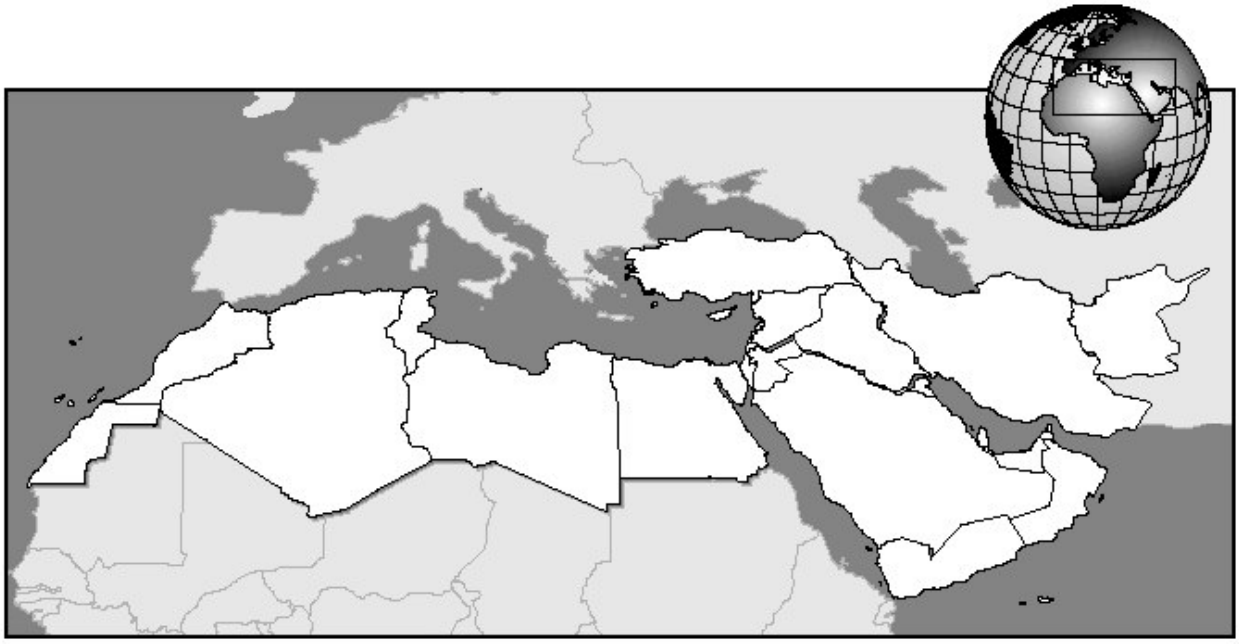
Southwest Asia
Leader's safety guide



U.S. ARMY SAFETY CENTER

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Foreword

Safety is essential to force preservation. Statistics show that—

- In World War II, one out of every five American soldiers killed, died as a result of an accident.
- In Korea, more than half the Army personnel who were hospitalized were injured in accidents.
- In Vietnam, accidents killed 5,700 soldiers, disabled more than 106,000 others, and produced nearly 5 million nondisabling injuries.
- In Operations Desert Shield and Desert Storm, accidents killed 88 soldiers, injured more than 1,100 others, and cost more than $122 million in equipment and property damage.

These are more than just numbers. They are a measurement of a serious loss of combat assets at a time when we could least afford to lose them—in the heat of battle. We must strive to keep such losses from happening on any future battlefield. We can do this by—

- Using risk-management principles to make informed decisions.
- Establishing and enforcing high standards of performance.
- Creating a command climate of “tough caring.”
- Recognizing the effects of stress and fatigue on performance.

Let us not forget that accident prevention is an important weapon in our arsenal. This pamphlet is a quick reference intended to help unit leaders prevent accidents in Southwest Asia and multiply our combat power by preserving our assets.

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Director of Army Safety

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Section I

Lessons Learned in Operations Desert Shield/Desert Storm

Our experience in Operations Desert Shield and Desert Storm highlighted certain unsafe situations, some of which led to accidents. This section offers suggestions on ways to eliminate these unsafe situations before they cause another accident in Southwest Asia. (See Sections II through VII for more information on these topics.)

Deployment

Situation: Individuals abandoned safety in an effort to establish "combat posture."

- Ensure that all personnel know and use the five-step risk-management process in all operations.
- Establish a command climate from the outset that promotes safety. Begin by establishing a safety network, designating safety personnel.
- Enforce standards; require all personnel to perform to standard in all operations.

Situation: Unsafe loading and shipment. Examples of violations include failure to identify and mark containers, mixing Class A explosives with incompatible Class C ammunition, corrosives improperly certified and mixed with unidentified hazardous lubricants, MRE rations and undocumented insecticides on same pallet, lack of MILSTAMP advanced cargo clearance, improper storage, and improper security.

- Train load teams to standard.
- Use Quality Assurance Specialist Ammunition Surveillance (QASAS) support.
- Secure all equipment stowed inside vehicles to deal with rough port handling and high seas.
- Comply with Air Force regulations in airlift of hazardous material (AFR 71-4) and with guidelines in TM 38-250 (1 March 1997).
- Ensure that vehicles have required tiedown shackles.
- Keep personnel out from under equipment being lifted aboard ship.
- Coordinate/understand requirements for "topping off" vehicles prior to shipment.

• Coordinate port of embarkation shipping requirements for bulk fuel/POL tank transporters through the servicing ITO.
• Ensure that vehicle master switches are turned off immediately after loading.

Situation: Chemical agent resistant coating (CARC) used to repaint vehicles for deployment.
• Ensure that CARC painting is done in accordance with established requirements.
• Caution users that CARC is flammable.
• Caution users that CARC is toxic and exposure can lead to respiratory problems.
• Ensure that users wear proper personal protective equipment.

Human factors

Situation: Air travel caused dehydration and fatigue.
• Encourage hydration before and during air travel.
• Ensure that arriving troops are given the opportunity to rehydrate and rest before being assigned duties.

Situation: Lack of depth perception in desert environment.
• Stress that lack of contrast in terrain features reduces depth perception.
• Tell vehicle drivers to follow proper ground-guide procedures.

Situation: Soldiers performing strenuous manual labor.
• In general, 2 weeks are required to adjust to the humidity and extreme heat. See Section II, Human Factors, for details.
• Remind soldiers to avoid strains and lifting injuries by using proper lifting techniques (lift with the legs, not the back) and getting help with heavy loads.

Situation: Soldiers injured during sports.
• Use designated officials to keep sports under control.
• Encourage the use of stretching exercises and warm-ups.
• Survey field of play for holes, rocks, and other hazards.

Aviation operations

Situation: Aviation units have problems maintaining standardization.
• Deploy standardization and safety personnel with the advance party.
• Develop unit training program to address new operational hazards.
• Establish a deployment library and take essential maintenance, operational, and training regulations and safety publications.

Situation: NVG operations in desert environment.

- Operate according to the crawl-walk-run philosophy, especially in an unfamiliar environment.
- Conduct detailed planning and mission briefings regardless of pilot experience.
- Establish all crewmember duties.
- Identify crew coordination requirements, especially during critical phases of missions.
- Remind crews that continuous scanning is a must and that the pilot on the controls must "stay outside."
- Require that all crewmembers assist in obstacle clearance.
- Remind aircrews that airspeeds must be adjusted downward during low illumination and visibility conditions and in areas of little or no contrast (go low, go slow).

Situation: Failure to establish Emergency Helicopter Instrument Recovery Procedures (EHIRP).

- Establish EHIRP for area of operation.
- Include EHIRP in mission briefings (unit SOP).
- Spell out crew duties and crew coordination requirements.
- Execute unannounced EHIRP whenever possible.

Situation: Failure to conduct local-area operation surveys.

- Survey area of operation, and establish hazard maps and restricted flight areas as first order of business.
- Brief manmade and natural hazards and obstacles for every mission.
- Brief all crewmembers on their responsibility for scanning to detect hazards and obstacles and to inform pilot on controls.

Situation: Uncommanded launch of ordnance from aircraft.

- Ensure that aircraft are downloaded or in a safe area when performing inspections or maintenance on weapons systems.
- Ensure that weapons are oriented away from other aircraft, troops, and facilities.

Ground operations

Situation: Vehicle operations result in accidents.

- Ensure that drivers are trained and licensed on the vehicle they are operating.
- Caution soldiers to drive defensively.
- Remind drivers to clear all sides before turning.
- Remind drivers not to allow passengers to ride on the outside of any vehicle unless it is command-directed.
- Caution drivers to use extra care when operating off improved roads; sand dunes drop off abruptly on the leeward side.

• Train soldiers on rollover procedures in the vehicles in which they operate; practice rollover drills.
• Instruct tracked-vehicle commanders to ride no higher than "name-tag defilade."
• Enforce safety-belt requirements.
• Remind drivers that driving too fast for conditions is a primary cause of accidents.
• Train drivers of M915 series vehicles in braking procedures.
• Train crews on vehicular fire drills; practice drills.
• Caution drivers that roads, bridges, and overpasses may not be posted with weight or height restrictions.
• Require safety briefings for senior occupants as well as vehicle drivers.
• Require the use of 10-foot extension hose for inflating and deflating split-rim tires.

Situation: Not enough attention to weapons safety.
• Review fratricide-prevention procedures.
• Remind soldiers to handle all weapons as though loaded.
• Caution soldiers not to play with knives.
• Do not allow target practice and blank ammunition to be mixed.
• Caution soldiers not to burn ammo boxes and to handle them with gloves; some are treated with PCP, which is toxic.
• Execute drills on rules of engagement.

Situation: Unsafe fuel handling and burning.
• Use FM 21-10 for guidance on proper fuel mixtures.
• Ensure that fuel is not used as a substitute for cleaning solvents.
• Prohibit burning of aerosol cans and unopened MRE packages; they will explode.
• Train soldiers in the process of burning human waste.

Situation: Eye exposure to sunlight degrades night vision.
• Enforce the wear of Ballistic Laser Protection System (BLPS). The sunglasses will reduce the adverse effects of sunlight on night vision. The sunglasses and clear lens will also protect against eye injury.
• If BLPS are not available, allow soldiers to wear sunglasses during the day to protect against night vision degradation.

Port operations

Situation: Secondary loads piled, scattered, or haphazardly placed in vehicles fell out as vehicles were being off-loaded.

- Ensure that secondary loads are secured to prevent motion-induced damage.

Situation: LOGMARS/AUEL data reflected only empty-vehicle weight; data did not include secondary load weights.

- Ensure AUEL/LOGMARS data reflect actual "as shipped" weight, not "as published" weights.

Situation: Secondary loads of *hazardous materials* were not reflected in LOGMARS data. Examples include ammo in ammunition carriers, maintenance trucks loaded with oil, grease, and oxygen and acetylene tanks; and HMMWVs carrying stinger missiles.

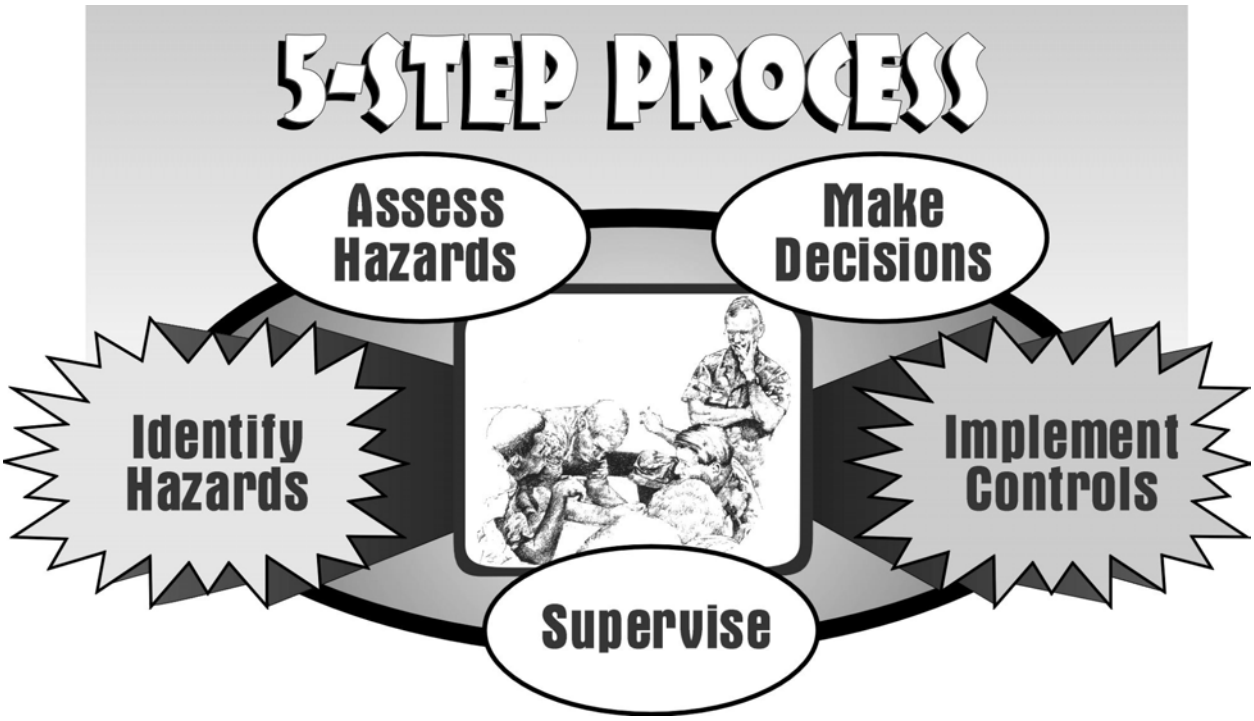
- Ensure segregation of hazardous cargo, and provide accurate LOGMARS data.

Section II

Risk Management

Risk management is the process of making operations safer without compromising the mission. It's a tool that allows soldiers to operate successfully in high-risk environments. Leaders at every level have the responsibility to identify hazards, to take measures to reduce or eliminate those hazards, and then to accept risk only to the point that the benefits outweigh the potential costs.

This section provides guidance on integrating risk management into all unit operations. (For more information, see appendix.)



Risk-management terms

Definitions

- **Hazard:** Any real or potential condition that can cause injury, illness, or death of personnel; damage to or loss of equipment or property; or mission degradation.
- **Risk:** Chance of hazard or bad consequences; exposure to chance of injury or loss. Risk level is expressed in terms of hazard probability and severity.
- **Exposure:** The frequency and length of time subjected to a hazard.

• **Probability:** The likelihood that an event will occur.
• **Severity:** The expected consequence of an event in terms of degree of injury, property damage, or other mission-impairing factors (loss of combat power, adverse publicity, etc.) that could occur.
• **Controls:** Actions taken to eliminate hazards or reduce their risks.
• **Risk assessment:** The identification and assessment of hazards (first 2 steps of risk-management process).
• **Residual risk:** The level of risk remaining after controls have been identified and selected for hazards that may result in loss of combat power. Controls are identified and selected until residual risk is at an acceptable level or until it cannot be practically reduced further.

• **Risk decision:** The decision to accept or not accept the risk(s) associated with a mission; made by the commander, leader, or individual responsible for performing that mission.

Risk-management process

Step 1—Identify hazards

• Consider all aspects of METT-T for current and future situations. Sources of information about hazards include reconnaissance, experience of commander and staff, safety SOP, and the unit's accident history.
• Hazards that cannot be adequately controlled by the unit or its subordinate units and that are most likely to result in loss of combat power should be risk-managed. To determine this answer the questions in figure 1.

Step 2—Assess hazards

• Assess each hazard to determine the risk of potential loss based on probability and severity of the hazard. Determining the risk from a hazard is more an art than a science. Use historical data, intuitive analysis, judgment, and the matrix at figure 2 to estimate the risk of each hazard.

Step 3—Develop controls and make risk decision

• Develop control measures that eliminate the hazard or reduce its risk.
• As control measures are developed, re-evaluate risks until all are reduced to a level where benefits outweigh potential cost.
• For each hazard, develop one or more controls that will eliminate or reduce the risk of the hazard. Specify who, what, where, when, and how for each control. When developing controls, consider the reason for the hazard, not just the METT-T factor itself (figure 1). Effective control can be implemented through individual and collective training that ensures performance to standard.
• As controls are developed for each hazard, re-evaluate the residual risk remaining assuming the controls are implemented. Then make the risk decision.

The commander, leader, or individual performing the mission decides whether or not to accept the level of residual risk. When the risk is determined to be too great to continue the mission, he or she develops additional controls or modifies, changes, or rejects the mission.

Step 4—Implement controls

- Put controls in place that eliminate the hazards or reduce their risks.
- Integrate specific controls into plans, orders, SOPs, training performance standards, and rehearsals. Knowledge of controls down to the individual soldier is essential.

Step 5—Supervise and evaluate.

- Enforce standards and controls.
- Evaluate the effectiveness of controls and adjust and update as necessary.
- Supervise controls by explaining how each control will be monitored to ensure proper implementation.
- Evaluate the effectiveness of each control in reducing or eliminating risk. For controls that are not effective, determine why and what to do the next time the hazard is identified (e.g., change the control, develop a different control, or change how the control will be implemented or supervised).
- Fix systemic problems (figure1) that hinder combat effectiveness.
- Capture and disseminate lessons learned.

		Yes*	No**
Support	Is type, amount, capability, and condition of the following support adequate to control hazard? •Personnel •Supplies •Equipment/materiel •Services/facilities		
Standards	Is guidance or procedure adequately clear, practical, and specific to control hazard?		
Training	Is training adequately thorough and recent to control hazard?		
Leader	Are leaders ready, willing, and able to enforce standards required to control hazard?		
Individual	Is soldier performance and conduct sufficiently self-disciplined to control hazard?		

*No further action required (subject to commander's risk guidance).
**Risk-manage this hazard.

Figure 1. Need to risk-manage a METT-T hazard

Risk-assessment matrix

The risk-assessment matrix (figure 2) is entered from the probability column and the severity row. Probability and severity levels are estimated based on the user's

knowledge of probability of occurrence and the severity of consequences once the

occurrence happens. The intersection of the probability column and the severity row defines the level of risk.

	HAZARD PROBABILITY				
SEVERITY	**Frequent**	**Likely**	**Occasional**	**Seldom**	**Unlikely**
Catastrophic	Extremely High	Extremely High	High	High	Medium
Critical	Extremely High	High	High	Medium	Low
Marginal	High	Medium	Medium	Low	Low
Negligible	Medium	Low	Low	Low	Low

Figure 2. Risk-assessment matrix for individual hazard

Hazard probability: The likelihood that an event will occur.
- Frequent: Occurs often, continuously experienced.
- Likely: Occurs several times.
- Occasional: Occurs sporadically.
- Seldom: Unlikely, but could occur at some time.
- Unlikely: Can assume it will not occur.

Severity: The degree of injury, property damage, or other mission-impairing factor.
- Catastrophic: Death or permanent total disability, system loss, major property damage.
- Critical: Permanent partial disability, temporary total disability in excess of 3 months, major system damage, significant property damage.
- Marginal: Minor injury, lost-workday accident, minor system damage, minor property damage.
- Negligible: First-aid or minor medical treatment, minor system impairment.

Risk level
- Extremely high: Loss of ability to accomplish mission.
- High: Significantly degrades mission capabilities in terms of required mission standard.
- Moderate: Degrades mission capabilities in terms of required mission standards.
- Low: Little or no impact on accomplishment of mission.

Sample Risk-Management Worksheet						
Hazards	Initial Risk Level	Controls	Residual Risk Level	How to Implement	How to Supervise	Controls Effective ?

Risk-management integration

Techniques

Two techniques are critical to maintaining unit battle focus:

- **Individual/leader risk management.** This technique focuses on individual through company-level-command thought processes to recognize hazards and take action to reduce risk. Use FM 22-100: *Army Leadership* problem-solving, decision-making, and planning processes. Identify the problem (hazard), gather information, develop courses of action, analyze and compare actions, make a decision, make a plan, and implement the plan. Memory aids such as METT-T and checklists promote consistency.
- **Command-echelon risk management.** This technique uses the FM 101-5: *Staff Organization and Operations Manual* military decision-making process. This process integrates safety and risk assessment into operational decisions normally associated with battalion and higher planning and operations. The commander directs the staff to identify necessary risks and risk controls as "considerations affecting the possible courses of action." Staff officers use memory aids such as METT-T to promote consistency. The final commander's estimate and concept addresses significant risk acceptance, eliminations, and controls. Implement these decisions directly into applicable areas of OPLANs (orders). Commanders must

ensure dissemination and enforcement of risk decisions and controls down to soldier level.

Basic METT-T hazards

The following METT-T hazards are provided to provoke thought about issues to consider in risk-management actions. They are not all-inclusive.

Mission

- Accelerated mobilizations with short preparation times.
- Multinational, joint service, and combined force; language and SOP differences.
- Command relationships.
- Contingency mission assignments with mission orders.
- Night operation emphasis.
- Combined-arms missions; more complex.
  - Boundaries/sectors
  - Communications
  - Coordination

Enemy

- Possible chemical-agent use.
- Aggressive, determined, war-proven enemy leadership.
- Seasoned, battle-experienced, well-equipped enemy.
- Enemy home-ground-advantage of area hazards and hazard utilization.
- Probable terrorist threats.
- Increased fratricide (friendly fire) threat due to—
  - Enemy and multinational force use of like equipment.
  - Long-range engagements due to favorable terrain.
  - Heat shimmer/dust interference with foe identification.
  - Fog of war.

Terrain

- Desert climate
  - Difficult to navigate
  - Intense heat (+140°F)
  - Humidity extremes
  - Normally no rain, but thunderstorms/flash floods possible in mountains and wadis
  - Strong winds (30 mph in p.m.; 75 mph in windstorms)
  - Large fluctuations in day and night temperatures (up to 70°F)
- Sandy deserts
  - Poor wheeled-vehicle off-road mobility/stability
  - Limited water sources

- Heat shimmer visibility degradation
- Lack of visual cues
- Undefined trail boundaries
- No natural shade
- Snakes, lizards, scorpions
- Sand storms
- Congested oasis sites

• Rocky, mountain deserts
- Poorly surfaced, boulder strewn, narrow, winding roads with steep shoulders and wash-outs
- Off-road-vehicle travel poor to impossible
- Limited water sources
- Mirage visibility degradation
- Snakes, lizards, scorpions
- Falling rocks

• Other areas
- Lava beds and salt marshes hazards to vehicle and parked/landing aircraft mobility/stability
- High-density urban market areas hazardous to mobility
- Congested bivouac, port, and staging areas
- Strong religion-influenced cultural taboos and lifestyle differences
- Roads heavily used by pedestrians and beasts of burden
- Little civilian compliance with established driving procedures, and no defensive-driving awareness
- High temperatures and humidity and intense light in coastal areas
- Water hazards in gulf coastal area
- Thunderstorms with flash floods and extreme mud in mountains and coastal areas
- Salt air and fog restrict visibility in coastal areas
- Petroleum facilities contain fire and poisonous-fumes hazards
- Snakes, scorpions, centipedes, sea snakes, spiders, bugs
- Strong vertical turbulence caused by high temperatures and heating
- Danger of hot metal burning flesh

Troops

• Assessment of training proficiency on complex tasks involving—
- NBC training
- Climate
- Desert operations
- Maintenance
- Desert survivability/operations training
- Heat-injury detection/prevention training
- Night-operations training
- Physical-fitness training
- Pilot/driver/operator training on local conditions

- Leadership training
- Troop acclimatization.
- Water availability.
- Troop morale, stress, esprit, discipline.
- Troop fatigue (quality and quantity of rest).
- Command climate and leadership quality.
- Accidental weapon discharge.
- Equipment status (increased maintenance requirements and long combat-service-support lines of communication).
- NBC-equipment heat stress and visibility/mobility degradation.
- Personal protective/safety equipment availability (goggles, work gloves, sunscreens, chapstick, eye ointment, canteens, helmets, flak jackets, ear protection, dust respirators, specialize equipment, and plastic bags to store individual clothing in for protection from bugs, etc.).

Time

- Little time for preparations (activations and mobilizations).
- Jet-lag effects.
- Intense pace.
- Constrained planning time (one-third/two-thirds rule).

Section III

Human Factors

The desert environment is obviously hostile toward soldiers. But there are ways you as a leader can reduce the hazards. This section discusses some of them.

Supervision

Statistics show that 80 percent of all accidents are caused by human error, and supervision is the key to preventing human error. Simply put, leaders can reduce human error by establishing sound standards and consistently enforcing them.

Failure to enforce a standard serves to establish a new, lower standard that may one day result in an accident. If, for example, you sit in the passenger seat and allow a driver to operate a vehicle too fast for conditions, you have failed to supervise, and you have failed in your leadership responsibility. You might make *that* trip; however, you've set the stage for a future accident.

Consistent enforcement demonstrates "tough caring," which is looking out for the welfare of soldiers.

Buddy system

Establish a buddy system and provide guidance on the issues buddies should help each other with. Examples include enforcement of water consumption; eating; personal hygiene; watching for sunburn, fatigue, sickness, heat injury, and cold injury; and swimming. Don't forget that leaders also need a buddy, because leaders frequently try to tough-out injuries to remain in the action.

Hot weather

Acclimatization

As a rule of thumb, 2 weeks are required to adjust to the region's humidity and extreme heat. The following chart is a reasonable guideline for minimal acclimatization.

Total Hours of Work*		
Day	Less than 80° WBGT	More than 80° WBGT
1	2 hours	2 hours
2	3 hours	3 hours
3	4 hours	4 hours
4	6 hours	5 hours
5	Regular duty	6 hours
6		Regular duty

*Hours should be evenly divided between morning and afternoon.

If time for acclimatization cannot be provided for your soldiers, supervision and the buddy system become even more important.

Sunburn

In extreme heat, the body is cooled by sweat. Since sunburn inhibits sweating, every precaution must be taken to prevent sunburn. Common sense dictates maximum use of shade, sunscreen, and/or clothing that covers as much exposed skin as possible. In addition, remind soldiers to use the buddy system to watch for signs of sunburn.

Water consumption/salt loss

When the body loses water, it also loses salt. Salt should be replaced by normal consumption of food. **Do not use salt tablets.**

An individual may lose more than a quart of water per hour through sweating. Water loss must be replaced by frequent intake of small amounts of water. Water should be sipped, not gulped. Do not conserve water. Soldiers *must* drink even when they are not thirsty! **Thirst is not an adequate indicator of dehydration.**

The following chart represents a modification of previous fluid-replacement guidelines. While still undergoing validation, it represents the best guidance currently available from the U.S. Army Research Institute for Environmental Medicine and the U.S. Army Center for Health Promotion and Preventive Medicine.

Fluid Replacement Guidelines for Warm-Weather Training
(Average Acclimated Soldier Wearing Hot-Weather BDU)

		Easy Work		Moderate Work		Hard Work	
Heat Category	WBGT °F	Work/Rest*	Water Per Hour	Work/Rest*	Water Per Hour	Work/Rest*	Water Per Hour
1	78-81.9	No limit	½ qt	No limit	¾ qt	40/20 min	1 qt
2	82-84.9	No limit	¾ qt	No limit	1 qt	30/30 min	1 qt
3	85-87.9	No limit	1 qt	40/20 min	1 qt	30/30 min	1¼ qt
4	88-89.9	No limit	1 qt	30/30 min	1¼ qt	20/40 min	1¼ qt
5	>90	No limit	1¼ qt	30/30 min	1¼ qt	15/45 min	1¼ qt

**Rest* means minimal physical activity (sitting or standing) and should be accomplished in the shade if possible.

Note 1: MOPP gear or body armor adds 10°F to WBGT Index.

Note 2: Hourly fluid intake should not exceed 1½ quarts. Daily fluid intake should not exceed 10 quarts.

Easy Work	Moderate Work	Hard Work
• Weapon maintenance • Walking hard surface at 2.5 mph, <30-pound load • Manual of Arms • Marksmanship training • Drill and ceremony	• Walking loose sand at 2.5 mph, no load • Walking hard surface at 3.5 mph, <40-pound load • Calisthenics • Patrolling • Individual movement technique; i.e., low crawl, high crawl.	• Walking hard surface at 3.5 mph, >40-pound load • Walking loose sand at 2.5 mph with load

Following these requirements will not necessarily prevent dehydration. Dark urine is an indicator of dehydration.

Alcohol and soft drinks are not substitutes for water. Alcohol exacerbates dehydration, and soft drinks are not absorbed as rapidly as water into body tissue. Soft drinks containing salts (e.g., *Gatorade*) may increase individuals' water requirements.

Soldiers who are overweight, dieting, or past heat casualties are more prone to heat injuries. As a result, their activities must be closely monitored:

- Enforce hydration and monitor water use.
- Provide cool water when possible.
- Enforce work/rest cycles.
- Watch for signs of heat injury (see below).
- Know individual physical conditions and assign appropriate work.
- Establish and ensure use of the buddy system.

Signs, symptoms, and first-aid

When prevention fails, it is critical that everyone be able to recognize and treat heat injuries. Following is a discussion of the most common injuries.

Heat cramps are caused primarily by excessive loss of salt from the body.

Symptoms: Muscle cramps of the abdomen, legs, or arms.

First-aid: Move the victim to shade and loosen clothing. Dissolve ¼-teaspoon table salt in one quart of water, and have the victim slowly drink at least one quart of the salt solution. Seek medical treatment.

Heat exhaustion is caused by excessive salt depletion and dehydration.

Symptoms: Profuse sweating, headache, tingling sensation in the extremities, weakness, loss of appetite, dizziness, nausea, cramps, chills, and rapid breathing.

First-aid: Move the victim to shade and loosen or remove clothing. Elevate legs, and pour water on the victim. Have the victim drink water, and fan him or her. Seek medical treatment.

Heat stroke is a medical emergency; immediate action is required.

Symptoms: Generally patterned after heat exhaustion; however, skin will be hot and dry. Victim may suddenly lose consciousness and have seizures.

First-aid: **Seek immediate medical attention.** Move the victim to shade and immerse in water if possible (cool water is even better) or douse with water. Fan and elevate feet. Ensure cooling process is continued during transport to medical facility.

Cold weather

Prevention

All too often we focus on *recognizing* and *treating* cold-weather injuries. However, the more important issue is *preventing* them. Consequently, first-line leaders should be trained on the following precautions and supervisory responsibilities to prevent cold injuries.

- Enforce the buddy system.
- Check each soldier for proper dress (gloves; loose, layered clothes).
- Ensure proper hygiene is practiced.
- Never allow a soldier to unnecessarily wear wet clothing.
- Require soldiers to change socks regularly.
- Identify and closely monitor personnel who have previously suffered a cold-weather injury; they are more susceptible.
- Understand that wind decreases the temperature (see wind-chill chart below).
- Enforce the requirement to hydrate; remember, thirst is not a reliable indicator of the need for water (see details in hot-weather section).
- Do not allow personnel to sleep in confined areas with vehicle-engines running (e.g., tanks, HMMWVs, communication vans, and APCs).
- Do not allow personnel to sleep in confined areas with portable heaters unless there is adequate ventilation.
- Provide fire guards in sleeping area, and brief them on the symptoms of carbon-monoxide poisoning.

WIND SPEED		COOLING POWER OF WIND EXPRESSED AS "EQUIVALENT CHILL TEMPERATURE"																			
KNOTS	MPH	TEMPERATURE (°F)																			
CALM	CALM	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	-55	-60
		EQUIVALENT CHILL TEMPERATURE																				
3-6	5	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	-55	-60	-70
7-10	10	30	20	15	10	5	0	-10	-15	-20	-25	-35	-40	-45	-50	-60	-65	-70	-75	-80	-90	-95
11-15	15	25	15	10	0	-5	-10	-20	-25	-30	-40	-45	-50	-60	-65	-70	-80	-85	-90	-100	-105	-110
16-19	20	20	10	5	0	-10	-15	-25	-30	-35	-45	-50	-60	-65	-75	-80	-85	-95	-100	-110	-115	-120
20-23	25	15	10	0	-5	-15	-20	-30	-35	-45	-50	-60	-65	-75	-80	-90	-95	-105	-110	-120	-125	-135
24-28	30	10	5	0	-10	-20	-25	-30	-40	-50	-55	-65	-70	-80	-85	-95	-100	-110	-115	-125	-130	-140
29-32	35	10	5	-5	-10	-20	-30	-35	-40	-50	-60	-65	-75	-80	-90	-100	-105	-115	-120	-130	-135	-145
33-36	40	10	0	-5	-15	-20	-30	-35	-45	-55	-60	-70	-75	-85	-95	-100	-110	-115	-125	-130	-140	-150
WINDS ABOVE 40 HAVE LITTLE ADDITIONAL EFFECT		LITTLE DANGER					INCREASING DANGER FLESH MAY FREEZE WITHIN 1 MINUTE						GREAT DANGER FLESH MAY FREEZE WITHIN 30 SECONDS									

Signs, symptoms, and first-aid

When prevention fails, it is critical that everyone be able to recognize and treat cold-weather injuries. Following is a discussion of the most common ones.

Frostbite is caused by freezing of tissue, normally due to exposure below 32°F. Seek treatment even if suspected.

Symptoms: Loss of sensation in affected area; tingling, blistered, swollen, or tender areas; pale, yellowish, waxy-looking skin (grayish in dark-skinned soldiers); or frozen tissue that feels wooden to the touch.

First-aid: Warm the affected area with direct body heat. Do not massage, rub, wet, use ice or snow, or expose the affected area to fire, stove, or other source of intense heat. Do not return victim to cold environment until medically evaluated.

Chilblain is caused by repeated exposure of bare skin for a prolonged period to temperatures from 20°F to as high as 60°F for those not acclimated to cold weather.

Symptoms: Swollen, red skin (darkening of skin in dark-skinned soldiers); tender, hot skin usually accompanied by itching.

First-aid: Same as frostbite.

Immersion foot (trench foot) is caused by prolonged exposure of feet to wet conditions at temperatures above freezing. Inactivity and damp socks and boots (or tightly laced boots that impair circulation) speed the onset and severity.

Symptoms: Cold feet, which may become numb; feet may later feel hot with shooting pain. There may also be swelling, redness, and bleeding.

First-aid: Rewarm feet by exposing to warm air; evacuate victim for medical attention. Do not massage, rub, moisten, or expose affected area to ice or intense heat.

Dehydration, which is depletion of body fluids, is as common in cold weather as in hot.

Symptoms: Nausea, dizziness, weakness, and blurred vision.
First-aid: Enforce hydration (see chart above).

Hypothermia is a life-threatening condition caused by prolonged cold exposure and body-heat loss. This may occur at temperatures well above freezing, especially when a person is immersed in water.
Symptoms: Shivering stops; drowsiness, mental slowness, lack of coordination; unconsciousness; irregular heartbeat.
First-aid: Strip off wet clothing; wrap victim in blankets or sleeping bag. Get victim to heated location; evacuate to medical facility.

Carbon monoxide is a poisonous gas most commonly generated by exhaust fumes from vehicles or other internal-combustion engines.
Symptoms: Headache, weakness, dizziness, blurred vision, nausea, vomiting, unconsciousness.
First-aid: Move personnel to fresh air, summon medical assistance, and administer artificial respiration if required.

Fatigue

Fatigue causes accidents. After 48 to 72 hours without sleep, soldiers become militarily ineffective. So, the best measure against fatigue is sleep. Water consumption, diet, physical conditioning, personal hygiene, and meaningful work all impact on fatigue. Ensure the impact is positive. (For more information, see *Leader's Guide to Crew Endurance*, which is available at the Army Safety Web Site, http://safety.army.mil.)

Risk management and crew endurance
See appendix.

Symptoms of fatigue
Watch for the following symptoms of fatigue:
- Headaches.
- Poor physical hygiene.
- Impatience/irritability.
- Loss of appetite.
- Inability to focus on task at hand.
- Outright physical exhaustion.
- Inability to make decisions.

These symptoms manifest themselves in—
- Increased errors.
- Difficulty in following instructions.

• Lack of motivation.
• Carelessness.

All this may translate into unnecessary risk-taking or shortcuts to get the job done—an open invitation for an accident.

Facts about sleep deprivation

• You cannot train to overcome sleep loss.
• Tasks—even *critical* tasks—that are uninteresting and take a long time are extremely conducive to sleep.
• Performance of mental tasks requiring calculations, creativity, and ability to plan ahead declines by 25 percent for every 24-hour period of semi-continuous work without sleep.
• The abilities of leaders are degraded by sleep loss, impacting on quick and effective responses to changing battlefield conditions.
• Tasks that have been well-learned and repeatedly practiced are more resistant to sleep-loss effects. Therefore, select the best trained to perform critical tasks.
• The ability to learn *new* information is compromised by sleep loss.
• Leadership ability cannot overcome sleep loss.
• Sleep loss over time (greater than 2 days) has a cumulative effect.

Guidelines for sleep plans

• 6-8 hours' sleep daily will maintain mental task performance indefinitely.
• 3-4 hours' sleep daily will maintain mental task performance for 5 to 6 days.
• Less than 4 hours' sleep daily over a 3- to 6-day period will impair military effectiveness.
• Best sleep periods, given limited choice, are 0300 to 0600 and 1600 to 1900.
• Provide for a *minimum* of 4 to 5 hours' quality (uninterrupted) sleep; however, after 6 to 7 days, accumulated sleep loss will equate to performance of 48 hours without sleep.
• After 25 to 36 hours without sleep, decisions and calculations should be cross-checked by a second person. Use a mix of rested and unrested soldiers as check and balance.
• Allow for naps as often as possible. Four 1-hour naps in a 24-hour period are as beneficial as 4 hours' sleep. However, accumulative sleep loss is more severe with fragmented sleep.
• Sleep plans should include provisions to recover from sleep loss:
  - 12 hours of sleep/rest (at least 8 to 10 hours' sleep) are required after 36 to 48 hours' acute sleep loss.
  - 24 hours of sleep/rest (at least 15 hours' sleep) are required after 36 to 48 hours' sleep loss under conditions of high workload (12 to 16 hours per day). This is particularly important for commanders/staff with high mental task workloads.
  - 2 to 3 days of sleep/rest are required after 72 to 96 hours' sleep loss. The sleep/rest period means 8 to 10 hours of sleep per day and light duty.

Personal injuries

Eyes
Precautions should be taken to protect the eyes by wearing protective lenses, goggles, or face shields when the job calls for it. In addition to sun and blowing sand, activities most likely to produce eye injuries are motor pool/maintenance work, and patrolling in brush areas, especially at night. Blowing dust also causes major problems for contact-lens wearers.

Ears
Leaders must enforce the use of hearing protection on firing ranges, when operating heavy equipment, when on board Army aircraft, and when operating Army combat vehicles.

Head
Helmets must be worn at all times by all personnel riding in or operating Army combat vehicles. Helmets or hard-hats must also be worn in construction areas in accordance with SOP and local and Army regulations.

Hands
Rings are a common source of personal injury. Soldiers frequently catch rings on the tailgate of vehicles while dismounting, causing severe hand injuries.

Back
In most cases, back injuries occur when individuals overextend themselves. Leaders must remind soldiers to get help when lifting heavy objects and to lift with their legs, not their backs.

Feet
Leaders must enforce the wear of protective boots in areas that require toe protection (e.g., maintenance, engineer, warehousing, and materiel-handling areas).

Health and hygiene

Water
- Remind soldiers to ensure that water is treated; serious diseases can be transmitted by untreated water.
- Warn soldiers not to use ice in drinks unless the water used was treated. Remind them to consider ice to be contaminated unless they *know* it has been treated. Emphasize that untreated ice can be used only for chilling containers.

• S*chistosomiasis* is a common parasite in bodies of water. Warn soldiers not to go into water unless it is necessary or an area approved by the chain of command.
• Maintain the chlorine level of water stored in trailers at 5 ppm.

Water purification

• Water purification requires use of hazardous chemicals. Ensure that soldiers wear eye protection and rubber gloves when handling these chemicals.
• Water purification operations create waste water. Ensure that waste water and waste chemicals are isolated from operational areas and disposed of in approved dump sites.
• Ensure that the Reverse Osmosis Water Purification Unit (ROWPU) power source is properly grounded.

Laundry and bath

• Laundry operations require equipment to be operated at specific temperatures; to prevent fires, ensure that temperatures listed in the appropriate operators manual are not exceeded.
• Ensure that laundry units operated inside tents have adequate ventilation.
• Ensure that high-voltage laundry units are grounded and that circuits are not bypassed.
• Ensure that operators are using fuels prescribed in the appropriate operators manual to prevent overheating and fire hazards.

Food

• Caution soldiers not to consume "local" foodstuffs, especially milk, goat cheese, and meat.
• Keep perishable foods below 45°F or above 140°F prior to serving.
• Dispose of perishable foods held in insulated containers more than 4 hours.

Critters

Snakes and insects

Bottom line—tell your soldiers to leave snakes alone. There are poisonous snakes in the region (e.g., Cobra and Desert Horned Viper). Even bites from nonpoisonous snakes can be harmful; if not properly cared for, nonpoisonous snakebites can become infected. Anyone bitten by *any* snake should seek medical help immediately for evaluation for anti-venom treatment. Tell soldiers *not* to treat snakebites with the cut/suck method.

Warn soldiers that snakes burrow under the sand seeking shade during the day and heat at night. Remind soldiers to avoid sudden motion when placing their hands or feet near an area that could conceal a snake. They should be especially careful when climbing or when lifting objects from the ground.

Scorpions, centipedes, assassin bugs, black widow spiders, mosquitoes, and sand flies can cause illness and infected wounds. Remind soldiers to shake out their clothing before dressing and to check boots before putting them on. Where possible, boots should be placed off the ground or inside a waterproof bag or other container. Soldiers should also carefully check their bedding before use. Also remind them that food crumbs attract insects, which in turn attract spiders and scorpions.

Direct soldiers to use insect repellents religiously and to use only those approved for human use. Deet repellent lotion is recommended (NSN 6840-01-284-3982). Also available is Permethrin clothing repellent (NSN 6840-01-278-1336). Caution soldiers to carefully follow instructions for use of these products. Also warn them to remain still if they feel an insect or spider crawling on their body. Sudden movement could cause a bite or sting.

Animals

Animals may be carriers of rabies. Warn soldiers not to taunt or play with animals.

Respiratory

Mucous membranes

Nostrils are subject to dry out from the arid climate. Tell your soldiers to wear a surgical mask or bandanna tied over their nose to reduce dust inhalation. Also tell them to cup water in their hands and "snuff" several times daily.

Hydrogen sulfide

Hydrogen sulfide is a gas emitted from petroleum-based products. It has the characteristic "rotten egg" odor. It is a systemic poison that can be fatal.

- Expect to encounter the gas around oil-well heads, drilling platforms, oil-storage tanks, and pumping stations. Locally produced diesel fuel contains hydrogen sulfide.
- The gas is heavier than air; therefore, it will concentrate in low areas (depressions) and confined areas such as cargo areas of ships.
- Handle diesel fuels in well-ventilated areas.
- Warn soldiers to notify their chain of command immediately if they smell the "rotten egg" odor. Medical personnel should check the toxic level to determine if it is lethal.

Caution: The odor may go away. However, that does not mean the gas is not still present. Hydrogen sulfide gas will cause olfactory fatigue (i.e., the brain ceases to recognize the smell).

Burning brush

Some species of brush, including oleander, are poisonous. Caution soldiers that inhalation of smoke from poisonous brush may cause respiratory problems, including sickness and, in extreme cases, death.

Burning equipment

Warn soldiers that gray smoke emitted from burning vehicles and aircraft may cause acute respiratory problems. Smoke and dust from a burning Abrams tank or tank ammunition could contain radioactive particles due to depleted uranium.

Lost

Terrain features are either absent or constantly changing. Counsel soldiers to follow the example of local residents and create "features" using stacks of rocks or pieces of cloth attached to poles to identify the route taken.

Vehicle movements

- Require that vehicles travel in pairs.
- Require drivers to file travel plans: route, times, stops.
- Require that assistant driver "stay on map."
- Require GPS on at least one vehicle in each convoy whenever possible.
- Establish a "help" signal and a signal SOP.
- Instruct drivers to stay with a disabled vehicle.
- Ensure that vehicles have basic survival items:
  - Basic issue items and small general-tool kit
  - Flashlight and warning triangles
  - Fire extinguisher
  - Compass, binoculars, map
  - Communication equipment
  - Shovel, sand ladders, tow rope/cable (at least 25 feet long)
  - Five gallons of water per vehicle occupant
  - Personal food, clothing, and equipment
  - Siphoning hose
  - Slave cables (one for each group of vehicles)
  - Jack support (1-square-foot of flat metal or wood)
  - Extra tires, oil, hoses, belts, tape, filters, antennas, twine or wire

Dismounted

- Use the buddy system. Two individuals missing will be noticed sooner than one, and two are less likely to become lost.
- Instruct soldiers to remain in place when lost.
- Review field-expedient methods of determining direction.
- Review field-expedient methods of map orientation.

- Counsel soldiers to use dead-reckoning to navigate.
- Place special emphasis on star reference for navigation at night.

Section IV

Aviation Operations

This section addresses areas of concern in aviation operations. Listed under each area are actions to take to reduce the hazards.

Crew rest/fighter management

Individual crew rest plan

There are several effective controls that nighttime aviation crewmembers can employ. Instruct aviation personnel to—

- Avoid exposure to daylight in the morning after flying a night mission. Exposure to sunlight before bedtime can severely retard adaptation to night shift and result in reduced sleep time and quality.
- Reduce unavoidable early-morning exposure to sunlight by wearing dark sunglasses.
- Try to begin sleep between 0400 and sunrise, and delay exposure to sunlight until noon.
- Engage in outdoor activities as much as possible in the afternoon.
- When possible, sleep in complete darkness and avoid even momentary exposure to sunlight during the sleep period.

Sleep quarters

- Isolate night-shift personnel from the activity of day-shifters.
- Reduce environmental noise as much as possible.
- Reduce sunlight in all living areas, including restrooms, during sleep periods.

All aircraft

Maintenance

- Use caution when touching aircraft surfaces or metal tools that have been exposed to the sun. Wear gloves and use mats or pads when practical to prevent burns and blisters.
- Inspect seals, tires, and such frequently for blisters and other signs of deterioration.
- Inspect vibration isolators frequently and replace where cracking or permanent set is excessive.

• Inspect and clean flaps, control hinges, pulleys, bearings, worm gears, cowl slides, and landing gear regularly to arrest corrosive action.
• Inspect dead air spaces in fuselage at regular intervals for accumulation of sand. Remove accumulated sand to prevent change in aircraft weight and balance.
• Clean instrument filters thoroughly at regular intervals. Replace worn-out filters promptly.
• Leave canopy partly open except during dust or rain storms to permit circulation of air within the flight compartment.
• Install protective covers and dust excluder plugs on all engine openings, vents, air intakes, exhaust outlets, breathers, propeller hubs and feathering domes, cowlings, and other vital openings to prevent entry of sand and dust.
• Keep aircraft pointed into wind when not being serviced or prepared for flight.
• Make all possible ground checks before starting engine. Inspect controls for freedom of movement to ensure no binding is caused by sand.
• Never use sand-encrusted tools on aircraft.
• Run up engines on a hard surface such as a landing mat or a sand- and dust-free area to prevent sandblasting.

Depth perception

• Remind pilots that radar altimeters provide the only effective reference to properly gauge altitude over expanses of flat "mirror" desert during the day. However, radar altimeter gauges elevation of ground ***below*** the aircraft, not ahead of it.
• Monitor shadows cast by near objects such as landing gear or skid shadows during hover.
• Keep windscreen and door windows clean of sand and dust.
• Caution personnel that, in areas of low contrast/definition, it's not uncommon for aircrews to inadvertently descend until they can detect visual cues, resulting in impact with the ground.

Overflying NVGs

• Slow airspeed to give more reaction time in areas of low contrast. In addition, terrain becomes more clearly defined and contrast is greater when the aircraft is flown closer to the ground.

Visual scan

• Do not stop scanning to channelize attention inside or outside aircraft. Scan stop of more than 3 seconds is risky. If pilot on controls must stop scanning, transfer controls; if pilot not on controls decides to stop scanning, announce intention.

Wire strikes

• Pilot in command: Conduct thorough hazard and obstacle briefing before each mission.

• Aircrews:
  - Mark all known wires and towers on hazard maps.
  - Ensure maximum crew coordination in searching out and calling out wires.
  - Go slow when you go low.
• Aviation safety officers: Promote wire-strike-prevention awareness in safety briefings.

Flying in MOPP gear

• Aircrews:
  - In aircraft not equipped with environmental control units, keep doors, windows, and vents open to increase ventilation.
  - If tactical situation permits, fly at higher altitudes where air is cooler.
  - Because the M24 and M43 protective masks reduce visibility, constantly scan in all directions.
  - Wearing the M24 mask for extended periods causes breathing resistance. Concentrate on breathing slowly.
• Commanders: Provide contamination-free areas where aircrews can rest.

Defensive measures during NBC operations

• Once chemical agents are employed or their employment is imminent, use M-9 paper or M-9 tape on windscreens, forward edges of stubby wings, etc., to detect chemical agents while in flight (FM 1-112, appendix E).

Survival equipment

• Before each mission check for presence and condition of desert survival kit (Hot Climate Individual Survival Kit, NSN 1680-00-973-1861 or Aircraft Modular Survival Kit, NSN 1680-01-362-6323/6324) and survival vest for each crewmember.

High-intensity radio transmission area (HIRTA)

• Mission planning should include consideration of potential effects of an electromagnetic environment.
• Report suspected instances of electromagnetic interference.
• Review classified HIRTA guidance information.

Helicopters

Brownout; blowing dust/sand

• Ensure that crews are familiar with procedures in aircraft operator's manual; chapter 2, FM 1-202: *Environmental Flight*.
• **Taxiing.** Get helicopter airborne as quickly as possible to minimize sand and dust intake by engines and danger of brownout.

• **Takeoff.** Maximum performance takeoff is recommended. Get through ETL/single-engine airspeed as quickly as possible to minimize sand and dust ingestion and to reduce possibility of brownout.

• **Flight and descent.** Avoid flying through sand or dust storms. Excessive dust and grit will cause damage to internal engine parts, excessive bearing wear, and erosion of rotor blades.

• **Landing.** Be prepared to make a go-around if necessary. Approach to touchdown should be made using approach angle greater than angle used for normal approaches. Approach angle should be compatible with available power. Land into the wind to reduce potential for brownout. Avoid formation landings whenever possible; in those cases where formation landings must be performed, plan them to take maximum advantage of wind direction.

• **Doors and windows.** Keep closed during takeoff and landing to help prevent sand from entering cockpit and cargo area.

Maintenance

• Provide crews with sand and dust goggles for wear during runup and shutdown procedures and when clearing aircraft.

• Keep aircraft clean, thus reducing wear and tear caused by a buildup of sand and dirt.

• Use protective covers between flights to protect aircraft from excess heat and to stop sand and dirt from getting into moving parts.

• Wipe oil and grease off engine decks and cowling-covered parts.

• Make sure all filters and air cleaners are inspected and cleaned daily.

• Cover radios and receivers with dust covers when possible. Clean ventilating ports and channels to stop overheating.

• Blow sand and dirt out of instrument panels, switches, flight controls, and cables.

• Tape all openings or seams around windows, chin bubbles, and access panels. Do not stop airflow that's needed to cool parts.

• Lubricate main and tail rotors after every flight or at least daily as per appropriate TM.

• Replace damaged sealant around windows, doors, and chin bubbles.

• Remove oil cooler compartment access panel daily, and clean caked dirt and sand off fan's inner lip.

• Keep windows clean and covered when aircraft are parked.

• Don't let covers touch windshield. Protect windows with Styrofoam, newspaper, cardboard, or other nonabrasive material—then attach cover.

• Add oil and hydraulic fluid directly from original unopened containers to help stop sand and dirt from getting into helicopter's lubrication and hydraulic systems. Dispose of partially used containers.

• Wipe off excess grease every time lubricant is applied. Grease attracts sand and dirt, forming a paste that grinds and wears lubricated parts.

• Inspect blades after every flight. High winds combined with sand or dirt landing pads can sandblast paint off blades.

Pressure/density altitude; weight and balance; wind

- Complete detailed performance planning.
- Remember that helicopter performance can be affected as soon as 1 hour after sunrise because of desert temperature extremes affecting DA.
- Consider the effect wind direction has on aircraft control during takeoff and landing.

Extended-range fuel system (ERFS)

The ERFS was designed for ferry flights on AH-64 and UH-60 helicopters; the tanks were intended to be removed and stored at the end of each mission. The tanks are neither crashworthy nor self-sealing. Operational requirements have put the systems into daily use on all types of missions. However, fueled ERFS degrade helicopter crashworthiness and increase the risk of postcrash fire at exit doors. Before using fueled ERFS, commanders and crews should ensure that—

- Internal crashworthy ERFS tanks are used when possible.
- Fueled external ERFS are used ***only*** when mission essential..
- Risk-assessment of missions involving use of fueled ERFS considers the following potential hazards:
  - Limited ballistic tolerance.
  - Increased airframe stress due to increased weight and maneuvering.
  - Potential for asymmetrical fuel transfer that can result in undesirable CG shift.
  - Increased difficulty in loading and unloading troops and cargo.
- Weapons traverse and elevation limiters designed for ERFS operations are installed.
- All requirements of AMCOM safety-of-flight messages UH-60-98-SOF-01 and AH-64-98-SOF-01, 271945Z January 98, subject: UH/EH-60 and AH-64 Aircraft, Risk Management of 230-Gallon External Tank Flight Operations are complied with.

Forward arming and refueling points (FARPs)

- When planning a FARP location, consider the prevailing winds. Plan for aircraft to land directly to a refueling point instead of a spot short of it that would require aircraft to hover, inducing blowing dust.
- Establish holding areas away from the FARP for aircraft awaiting refuel/rearm space.
- Ensure that shutoff valves are marked and that all personnel using or running equipment know how to shut it off.
- Mark refueling points, areas around aircraft tail rotors in combined refueling and rearming points, and passenger-holding areas.
- Require daily inspection of grounding systems.
- Ensure fuel and ammunition handlers are familiar with FM 10-67-1 and FM 1-104 procedures.

• Use extreme care when handling engine fuel at temperatures above 120°F to prevent possible sparks and explosion. Open gasoline drums with bronze or other nonsparking tools.
• Look for and correct improper grounding points, deteriorated or leaking hoses, leaking nozzles, incorrect sampling procedures, improper storing or dumping of waste POL products, lack of personal-protective equipment for refueling personnel, no water at refueling site, unserviceable fire extinguishers, and no controlled access into and out of refuel points.
• Keep gasoline drums covered and, where possible, maintain storage temperatures below 120°F.
• Remember that fuel expands in very hot temperatures.
• Ensure that fuel does not become contaminated by dirty nozzles and other unclean equipment.
• Consider positive control of air traffic and ground traffic around refueling sites to reduce potential of midair/ground collisions.
• Keep camouflage materials (netting/foliage) as far from rotor-blade systems as possible to prevent FOD.

Warning: High-frequency radios will not be operated within 100 feet of aircraft being armed and/or refueled.

Caution: At 111°F., white phosphorous (WP) tends to liquefy, affecting ballistics of WP rounds.

• Enforce requirement for at least two qualified personnel to arm an aircraft.
• Ensure that weapons are on safe before arming.
• Ensure that guns are oriented away from unit assets during rearming.
• Require frequent cleaning and lubrication of turret weapon systems to prevent jamming due to sand.
• Require daily inspection of grounding/bonding systems.

Caution: The region is known as a static electricity hazard area.

• Be aware of fire-hazard possibility from static electricity. Connecting the nozzle bonding wire before opening the fuel cap will prevent a static arc from occurring in the presence of fuel vapor and significantly reduce the fire hazard.

Lasers

• Establish policy for wearing of laser-protective visors and glasses/goggles.
• Treat hand-held laser devices as if they were loaded weapons.
• Do not aim laser range-finders or target designators at nontarget personnel, vehicles, or passing aircraft.

• Do not place hands in front of any laser device.
• When using binoculars or image-magnification devices in area of lasers, ensure proper filter is being used.
• Do not perform maintenance work on laser systems until power is off and residual charge in any power supply capacitors has been bled off.
• When maintenance *must* be performed on "on-line" laser systems, output must be blocked or enclosed.

Section V

Ground Operations

This section addresses areas of concern in ground operations. Listed under each area are actions leaders should take to reduce the hazards.

All vehicles

Night tactical operations

Ensure that personnel who operate vehicles at night are thoroughly trained in—

- Dark-adaptation and night-vision techniques.
- Ground guiding procedures.
- Sensory illusions at night.
- Use of night-vision devices.

Preventive maintenance checks and services (PMCS)

- Stress that PMCS is especially critical in hot, dusty conditions.
- Ensure that operators know that, due to severe environmental conditions, they must perform daily PMCS even if equipment is not used.
- Stress that drivers must perform special requirements covered in the "Operating Under Unusual Conditions" section of their respective operators manual.
- Remind personnel not to walk or work between vehicles that are running (including when slave starting, towing, or cross-loading ammunition).

Sand conditions

- Ensure that drivers and assistant drivers are issued protective goggles.
- Provide instruction about tire pressure and hands-on training in gear selection, crossing dunes, stopping in sand, and other sand-driving skills (FM 21-305 and FM 21-306).
- Ensure drivers refer to appropriate vehicle operator manual for "Operating Under Unusual Conditions."
- Provide instruction in vehicle control in strong wind and blowing sand conditions.
- Ensure that wheeled vehicle drivers received hands-on training in driving in sand, to include the following:
  - Reduce tire pressure for soft sand and dunes, and drive at slow speed. Inflate tires to normal pressure as soon as situation permits. (Prolonged driving on partially deflated tires will overheat tires and break down sidewalls.)

- Select a gear or range that will start vehicle with a minimum of clutch slippage and wheel spinning.
- Maintain a steady, even rate of movement.
- Avoid unnecessary gear shifting. Keep automatic transmissions in low range.
- Approach dunes from the windward (most gradual) slope at a 90-degree angle after selecting gear or range to avoid shifting on slope. Maintain momentum during ascent.
- Make wide turns.
- Brake gradually or allow vehicle to roll to halt. Stop on downhill slope when possible. (Abrupt stops may cause vehicle to sink into loose sand and become stuck.)
- FM 21-305 provides additional guidance.

• Ensure that tracked-vehicle drivers receive hands-on training in driving in sand, to include the following:
- Do not make pivot turns.
- Do not straddle sand mounds or drive on sides of two sand mounds. (Loose sand will not support tracked vehicles on steep slopes.)
- Keep speed steady after reaching desired speed.
- Turn slowly on loose sand.
- Steer straight up and down hills if possible.
- Be wary of a lack of steering response, which indicates sand is building up between rear sprockets and treads. If allowed to continue, sand buildup will force the track off. “Shaking” the vehicle with the steering or backing up will throw off the sand.
- FM 21-306 provides additional guidance.

Built-up areas/local driving

• Provide instruction in local driving customs and practices. (Accident experience shows local drivers to be very unpredictable, often showing complete disregard of traffic signs and signals, turning left from the right lane or right from the left lane, and making U-turns in intersections.)

• Avoid areas of high civilian-vehicle concentration.

• Stress need for constant alertness and to always expect civilian vehicles to do the unexpected.

• Ensure all drivers are aware of flash-flood dangers: frequency of rainstorms, low areas, effect on roads and traffic.

Speed

• Establish and enforce safe speed limits for various road and environmental conditions.

Safety belts

• Enforce the requirement to use safety belts.

Driver selection

- Pair an experienced driver with an inexperienced one to provide supervision and hands-on training.
- Identify soldiers who are not licensed to operate vehicles and ensure they are not tasked to drive.

Rollovers

- Enforce requirement for crewmembers to maintain name-tag-level posture any time vehicle is moving.
- Practice rollover crew drills.
- Instruct drivers on conditions that can lead to rollovers; steep slopes, ditches, loose sand, etc.
- Enforce use of safety belts by crew and passengers.
- Ensure equipment is secure to prevent injury from falling equipment or cargo.
- Enforce posted and briefed speed limits.
- Remind drivers to slow down in limited visibility, on rough terrain, and during inclement weather.
- Caution drivers to avoid steep slopes and narrow trails. (Leaders must also keep this in mind when planning vehicle moves.)
- Remind drivers to give special care to tire, track, and suspension checks.
- Caution drivers to drive at moderate speed and make wide turns at slow speed to maintain vehicle control (especially critical in sand).

Backing

- Ensure that drivers properly use ground guides (see section on ground guiding).

Rear-end collisions

- Stress safe following distance.
- Remind drivers that when in blackout conditions, they should watch the rear blackout marker lights of the vehicle ahead. Ensure they know the distances different marker readings indicate. (When a driver sees one point of red light at each rear lamp of the vehicle ahead, he is more than 180 feet behind it; if he sees two points of light, he is following 60 to 180 feet behind it; if he sees four lights or two pairs of "cat's eyes," he is less than 60 feet behind it.)
- Establish speeds for blackout driving under different conditions, including blowing sand.
- Establish procedures for vehicle stops and breakdowns to warn approaching vehicles in blackout, sand-storm, and other restricted visibility conditions.

Passenger/cargo transport

- Supervise cargo loading to ensure load is secured and weight is correctly distributed (especially when traveling over sandy terrain).
- Enforce wear of safety belts and helmets.
- Use fixed seating in truck cargo beds.

• In cargo beds without fixed seating, ensure passengers remain seated within truck body.

Crew coordination

• Stress importance of maintaining crew coordination.
• Remind drivers/track commanders to warn crews and passengers when they are about to cross a ditch, climb an obstacle, or take any action likely to catch personnel off balance.

Tracked vehicles

Hatches and latches

• Make sure safety pins are present, operational, and used.
• Require daily PMCS to ensure hatches and doors are functioning correctly.
• Notify crew of hatches and doors that are unserviceable.
• Ensure helmets are worn.
• Ensure bad latches and pins are replaced immediately.
• Require crews to check hatch, latch, and pin function throughout the mission.

Turrets

• Remind crews to ensure that drivers hatch is closed and that driver is in position before operating turret.
• Remind crews to maintain proper communications between crewmembers at all times.
• Brief and train crewmembers and passengers about turret hazards.
• Advise crew and passengers on the tactical situation so they can anticipate turret movements.
• Stress importance of announcing "power" before traversing turret.
• Remind crews to turn turret power off before leaving turret station.

Fires

• Practice crew drills for emergency fire escape.
• Require complete electrical inspection (no loose connections, no frayed/worn wires, and no wires that run over hot or sharp objects) in accordance with appropriate operators manual.
• Ensure that fuel systems are inspected for leaks, and ensure lines do not run over sharp objects or rub, causing breaks or tears.
• Train/supervise crew activities involving ammunition in accordance with dash-10 procedures.
• Require inspection of fire extinguisher bottles to ensure they have been tested/weighed and properly connected to discharge lines and external pull handles.
• Require inspection of fire extinguishers and refresher instruction for crewmembers in proper extinguisher operation.

• In extremely dusty conditions, ensure that fire detectors are cleaned every 4 hours.

General

• Ensure soldiers get help to mount/load heavy objects.
• Require that head protection be worn in and around vehicles.
• Stress hazards of slippery footgear and slippery vehicle surfaces.
• Emphasize use of gloves (protection from extremely hot surfaces) and maintaining three points of contact while moving about vehicles and equipment.
• Do not allow soldiers to jump from vehicles.

Convoys

Speed

• Establish and enforce safe convoy and catch-up speeds for expected road and environmental conditions. Include in pre-march briefing.
• Set speeds based on personnel, training, terrain, environment, and equipment (see section on night-vision devices).

Rear-end collisions

• Provide adequate driver rest before starting.
• Establish speed and following distance guidelines. Increase following distance in bad weather and darkness. Include in pre-march briefing.
• In blackout conditions, ensure drivers watch the rear blackout marker lights of the vehicle ahead. Ensure that they know the distances different markers indicate. (When a driver sees one point of red light at each rear lamp of the vehicle ahead, he is more than 180 feet behind it; if he sees two points of light, he is following 60 to 180 feet behind it; if he sees four lights or two pairs of "cat's eyes," he is less than 60 feet behind it.)
• Establish speeds for blackout driving under different conditions, including blowing sand.
• Establish procedures for vehicle stops and breakdowns to warn approaching vehicles in blackout, sand-storm, and other restricted-visibility conditions.

Loss of control/rollovers

• Use experienced drivers in difficult terrain.
• For off-road movements, when possible, conduct a physical reconnaissance of the route to avoid the worst terrain hazards. Mark unavoidable hazards on strip map and include them in the pre-march briefing.
• Check loads to ensure cargo is correctly secured. Stress even load distribution, especially when traveling over sandy terrain.

Clearance

- Recon the route for bridges or underpasses that may be too low for large vehicles.
- Recon routes for mountain passes or any sharp turn that might require special control measures.

Materiel failure

- Have all drivers perform PMCS before departure, during halts, and after completion.
- During halts, in addition to normal during-operation PMCS, emphasize tire/track pad condition and load security.
- During operation, have drivers pay particular attention to air-cleaner indicator and water and transmission gauges.
- Ensure that operators know proper cool-down procedures for their vehicles. Procedures are spelled out in appropriate operators manuals.
- Ensure that vehicle basic-issue items, pioneer tools, highway warning devices, and fire extinguisher are present on every vehicle.
- Ensure that disabled vehicles are moved completely off the roadway.

Local driving practices

- Provide instruction in local driving customs and practices. Avoid areas of high civilian-vehicle concentration. Stress staying alert and to expect civilian vehicles to do the unexpected. Include in pre-march briefing.
- Plan convoy movement to avoid peak traffic periods when possible.

Passengers

- Enforce requirement to wear available safety belts and helmets.
- Use fixed seating in truck cargo beds.

General

- Do not place vehicles transporting troops, ammunition, or POL last in a serial or march unit.
- Ensure all prime movers and trailer brake systems are properly connected and fully operational.
- Reinforce braking and downhill driving procedures with all operators.
- Warn soldiers to remove all rings, bracelets, wristwatches, and neck chains before working around vehicle batteries and other equipment.

Convoy checklists

Following are detailed checklists that commanders, convoy planners, and unit safety personnel can use to ensure that convoys to and from the seaport of debarkation are professionally and safely planned.

Route selection

Ask the convoy commander or convoy planner these questions.

- Has map reconnaissance been completed?
- Has a physical reconnaissance been made of the entire route?
- Can all vehicles clear bridges, underpasses, tunnels, and other clearance and weight limits? If not, have alternate routes been selected?
- Have urban or potentially congested areas been identified?
- To avoid congestion, have alternate routes been selected?
- Has convoy movement been planned to avoid peak traffic periods?
- Have alternate routes been selected for vehicles transporting oxygen, acetylene, or other compressed gases?
- Have strip maps of the entire route been prepared?
- Does each convoy vehicle have a strip map?
- Have traffic control points been established at hazardous locations?

Start and release points

Ask the convoy commander or convoy planner at battalion-level these questions.

- Is adequate space available for vehicle organization and lineup at start point?
- Is sufficient space available for maneuvering of vehicles, sequential lineup of vehicles, and march units and serials?
- Has arrival time at release point been established?
- Is adequate space available for safe vehicle release?

Controlled-access highways

If convoy movement will take place on controlled-access highways (those where entry and exit is permitted only at specific points), ask the convoy commander or convoy planner these questions.

- Have halt areas been identified along the route?
- Has a 15-minute halt been scheduled after the first hour, and 10-minute halts every 2 hours thereafter?
- Are all halts planned in designated rest areas?
- Have all halt areas been physically reconned to ensure sufficient capacity?
- Are halt areas shown on strip maps?
- Are halts scheduled to avoid overloading of halt areas?
- Do areas for meal halts contain—
  - Sufficient areas for cooking and eating?
  - Waste-disposal facilities?
  - Latrines?
- Do bivouac sites contain—
  - Sufficient area for cooking, eating, and sleeping?
  - Waste-disposal facilities?
  - Latrines?
  - Area for vehicle maintenance?
  - Security for cargo?

Conventional highways

Ask the convoy commander or convoy planner these questions.

- Have halt areas been identified along the route?
- Has a 15-minute halt been scheduled after the first hour, and 10-minute halts every 2 hours thereafter?
- Are halt times adjusted to permit halts at safe locations?
  - Location is away from urban or heavily congested areas.
  - Terrain permits vehicles to completely clear highway traffic lanes.
  - Location avoids curves or reverse sides of hills (blind spots from approaching vehicles).
  - Location permits minimum of 3 feet between parked vehicles.
- Are halt areas shown on strip maps?

Convoy organization

Ask the convoy commander or convoy planner these questions.

- Are convoys of more than 20 vehicles separated into serials?
- Are serials divided into march units if required?
- Is convoy element size based on capacity of halt/bivouac areas?
- Have the following personnel been designated and briefed?
  - Commanders for each serial and march unit.
  - Pace setter.
  - Trail party.
  - Claims officer.
  - Drivers and assistant drivers.
- Are vehicles transporting troops not the last vehicle in a serial or march unit?
- Are empty vehicles or those carrying general cargo used as buffers (i.e., last vehicle in convoy)?
- Are recovery and medical vehicles near the rear of the convoy?
- Is the convoy organized initially within 5 minutes between march unit and 10 minutes between serials?
- Have adjustments to time gaps been identified and planned for?
- Are convoy and convoy-element commanders positioned for best convoy control?
- Has convoy operation during periods of darkness been avoided?
- Are the following proper vehicle intervals planned?
  - Controlled-access highway: 220 yards
  - Rural conventional highway: 150 yards
  - Urban conventional highway: 50 yards
- Does each driver have a strip map?
- Is the convoy commander checklist completed?

Convoy ID and communications

Ask the convoy commander or convoy planner these questions.

- Are lead, rear, and element commander vehicles correctly identified?
- Are flags and signs correctly mounted on each vehicle?
- Is each convoy identified by a convoy clearance number?

- Has method of communication been decided?
- Has radio equipment (ideally, 2-way radio in first and last vehicle of each serial and unit) been checked and assigned to vehicles?
- Have signal operating instructions been provided to vehicles with radios and the liaison team?
- Have personnel been briefed on visual and audio signals?
- Have road signs and messages been constructed and placed as required?

Logistical support

Ask the convoy commander or convoy planner these questions.

- Are medical personnel scheduled and posted in rear of convoy?
- Are sufficient food and mess personnel and facilities available?
- Do all personnel have proper clothing and equipment?
- Has weather briefing been obtained for duration of convoy operation?
- Have provisions been made for obtaining weather updates?
- Is special equipment available based on weather requirements?
- Have weather effects been determined and planned for on halts, meals, and bivouacs?

Convoy personnel briefing

Ask ONLY the convoy commander whether leaders have given drivers the following instructions.

- Permit emergency halts only on roadside of controlled-access highways.
- Permit only guards and maintenance personnel on traffic side of convoy during halts on conventional highways.
- Drivers and assistant drivers perform vehicle operator maintenance and check cargo security at every stop.
- Have guards stand 50 yards behind department convoy to warn traffic on conventional highways.
- Assistant drivers will remain awake *and* alert.
- Reflectors and warning devices must be in place before beginning maintenance.
- Warning lights are used during periods of darkness or low visibility.
- Convoy begins only at convoy commander's signal.
- In case of accident, main column does not stop to provide assistance. Next following vehicle provides immediate assistance to accident vehicle.
- If an accident occurs to vehicle ahead, make maximum effort to clear traffic lanes.
- First officer or NCO at accident scene takes charge.

Refueling and maintenance halts

Ask the convoy planner these questions.

- Are sufficient supplies of diesel, mogas, and oil available for refueling?
- Are refueling halts planned for bivouacs? If not, is refueling planned for noon meal halt?

• Have vehicle operator maintenance checks been scheduled for every halt? Who inspects the drivers for signs of fatigue? What is the plan for driver changes?
• Are sufficient maintenance vehicles and equipment available in rear of convoy?
•Are spare vehicles available for emergencies?
• Are all vehicle refuelers properly equipped and trained?

Vehicle preparation

Ask the convoy planner these questions.
• Have participating units been notified as much in advance as possible?
• Have all vehicles been inspected in vehicle-assembly area?
• Have all spot corrections been made on vehicles?
• Does the loading and unloading plan include—
- Designation of persons to execute plan?
- Times and locations for loading and unloading?
- Orders not to load troops in vehicles with motor fuel or hazardous cargo?

Driver preparation

Ask the unit or convoy commander these questions.
• Are all drivers qualified in assigned vehicles?
• Are drivers and assistant drivers assigned to each vehicle?
• Do all drivers have government drivers license (OF 346)? If not, have arrangements been made to test drivers or obtain alternate drivers?
• Are experienced drivers being used to the maximum extent possible? If not, are less-experienced drivers scheduled for training?
• Have drivers and assistant drivers been scheduled to split driving periods?
• Have all drivers received adequate rest prior to departure?

General precautions and procedures

Check these items yourself or ask the convoy commander.
• Are warning lights on first and last vehicle?
• Are fire extinguishers and first-aid kits in vehicles?
• Is a basic convoy warning kit in each vehicle?
• Are vehicles carrying hazardous material marked?
• Do road guards have safety warning equipment?
• Are maintenance, wrecker, and recovery vehicles marked?
• Are accident procedures for the convoy established, to include—
- Trail officer designated to supervise care of injured and disposition of damaged vehicles?
- Notification of convoy commander, safety officer, and civilian police of accidents?
- Reporting of accidents IAW AR 385-40?

Weapons handling

General

- Construct "clearing barrels" at TOCs, first-aid stations, mess tent, and other appropriate areas and enforce proper clearing procedures before entry.
- Ensure fields of fire at guard points do not fall onto friendly positions.
- Ensure that soldiers are proficient in combat identification and rules of engagement.

Maintenance

- Establish weapons lubrication policy.
- Require that weapons, ammunition, and magazines be kept clean.
- Require that muzzles be covered to prevent clogging.
- Conduct head-space and timing in accordance with TM. Caution soldiers to not rely on memory, to always verify.

Lasers

- Remind soldiers to treat all lasers as direct-fire weapons.
- Use only trained personnel to operate/handle lasers.
- Caution personnel to never fire at specular surfaces such as glass, mirrors, and windows.
- Ensure laser safety filters are installed on binoculars and other optical devices when observing laser operations.
- Ensure that eye protection is available and worn.
- Ensure laser safety procedures are established and implemented for each device being used.
- Conduct safety briefings on all Class II and higher lasers, specifying the needed eye protection and viewing limitations.

Fratricide/friendly fire

General

- Always ensure positive target identification.
- Ensure that task standards are followed (i.e., weapons handling, powder-charge preparation, fire and maneuver).
- Ensure that warnings and reports are timely and accurate.
- Ensure that soldiers are well trained in land navigation. Reconnoiter when possible.
- Anticipate the effects of stress and fatigue on soldiers.
- Anticipate the effects of battle (limited visibility, unsynchronized actions, chaos and confusion).

Mission

- Conduct rehearsals with leaders and soldiers.
- Know and physically identify all attachments.
- Know the commander's intent.
- Keep plans simple and synchronized.
- Conduct a fratricide risk assessment.

Enemy

- Know and be able to positively identify the enemy (uniforms, weapons, special markings).
- Know the effects of terrain and weather in offering advantages to enemy operations.
- Know equipment capabilities of enemy.

Terrain and weather

- Know and use OCOKA factors.
- Know navigation obstacles and enhancements.
- Become familiar with the operational terrain; reconnoiter when possible.
- Identify battlefield hazards.
- Determine the impact of potential battlefield obscuration.
- Anticipate the effects of weather.

Troops and equipment

- Ensure that soldiers are proficient in combat identification and rules of engagement.
- Train in all collective and individual tasks.
- Determine readiness of attachments.
- Train to standard on NVGs and land-navigation equipment.
- Ensure redundancy in communications equipment.
- Know weapons systems' capabilities.

Time

- Control the pace of the operation.
- Develop sleep/work plans for continuous operations.
- Provide sufficient preparation time.

Other prevention methods

- Conduct crew and battle drills.
- Enforce assembly-area procedures.
- Use training devices when possible.
- Use distinctive/thermal markings when tactically sound.
- Use navigation aids.

NBC operations

MOPP

- Caution soldiers that protective masks will require more PMCS in a hot, sandy environment. (Sand will clog filters and cause valves to malfunction .)
- Remind soldiers that amyl acetate (banana oil) vapor is toxic and flammable. Checking the seal of the protective mask should be done in a well-ventilated area away from heat and flames.
- Increase WBGT by 10°F for operations in MOPP. Increase water consumption correspondingly (see human-factors section).
- Practice drinking while wearing mask.
- Remind soldiers that command drinking policy is even more important when in MOPP.
- Plan additional time to conduct operations (up to 6 times longer). Rotate personnel more often.
- Allow personnel to loosen protective clothing as situation permits.
- Employ buddy system to check for heat injuries. Ensure that leaders are included.
- Delegate tasks to subordinates to reduce stress and fatigue. (Experience shows that leaders are most likely to suffer adverse effects of operating in MOPP.)

M43 protective mask

- Do not expose blower or battery pack to temperatures above 160°F.
- Do not allow battery pack or blower to remain in contact with hot metal surfaces.

Power-driven decontaminating systems

- Ground the M12A1 decon system when refueling.

Fires

- Store DS2 and STB separately.
- Do not spray DS2 on hot metal surfaces.

Chemical burns

- Store containers of DS2, STB, and the M13 decon apparatus out of direct sun to avoid over-pressurization of containers and leaking.
- Remind users to wear rubber gloves when handling containers of decontaminants.

Radiation

- Ensure radiation protection officer (RPO) develops SOP for accountability of commodities with radioactive sources.
- Ensure RPO checks for current wipe test on commodities and storage.

• Have RPO and safety officer train soldiers on storage and proper handling of unserviceable commodities (M8, M2, and other equipment containing radioactive material).

Night-vision devices

Preparation for use

• Ensure soldiers know the limitations of the night-vision devices (NVDs) being used.

- Reduced field of view (from 188 degrees unaided to about 40 degrees with NVGs.) Remind soldiers that they must scan to make up for this limitation.
- Reduced visual acuity as illumination is reduced.
- Reduced depth perception and distance-estimation ability. Remind soldiers that they may tend to over-estimate distance and under-estimate depth, particularly in low light.
- Dark adaptation. Remind soldiers that, when goggles are removed, it takes about 30 seconds for the eye to adapt to current conditions. This is especially important when the goggles are being used in the binocular mode.

• Ensure soldiers get adequate rest and eat well-balanced meals.

• Advise soldiers to avoid use of tobacco, alcohol, and self-medication. (They impair night vision.)

• Remind users to avoid bright light, including sunlight, and to wear sunglasses when outside.

• Remind users that goggles may not make drop-offs and ravines visible.

Driving

• Warn drivers against overconfidence and to avoid normal tendency to over-drive capabilities of NVDs.

• Remind users to use continuous-scanning technique.

• Remind users that effectiveness is greatly reduced in dust, haze, fog, smoke, and rain and during mirage effect. Slow down.

• Remind users to keep light sources outside NVD field of view.

• Conduct refresher training for drivers who have not completed an NVD driving task or mission in the past 6 months.

Personnel

• Ensure eye guards are in place to prevent recoil injury.

• Caution soldiers that haste will cause accidents.

Equipment damage

• Ensure personnel are properly trained in maintenance and use.

• Remind users to avoid pointing goggles into the wind if possible.

• Ensure that users remove all dust and sand from goggles after use.

• Remind users to keep carrying-case closed unless removing or replacing items.
• Remind users to protect optics from light sources, intense heat, direct sunlight, dust, and sand.

Ammunition and explosives

General precautions

• Expose only the minimum number of people and amount of equipment necessary to ammunition and explosives.
• Handle ammunition carefully. Containers must not be tumbled, dropped, thrown, rolled, or dragged (unless designed for dragging).
• Make provisions to evaluate and, if necessary, segregate damaged ammunition.
• Caution soldiers not to disassemble or destroy enemy equipment or ammunition without authorization. Unknown ammunition stocks should be carefully examined by ordnance experts before demolition or shipment.
• Coordinate with QM laundry to wash clothing with an antistatic additive to reduce static electricity.
• Don't use sparking metallic tools on explosives; take precautions to reduce static-electricity discharge.
• Determine if your area of operations is susceptible to electrical storms and establish lightning-protection procedures.
• Monitor suspension/restriction notices. Suspended lots should be visibly marked and physically separated from serviceable unit basic load (UBL).
• Do not remove ammunition from its packaging until you have to. Ammunition containers provide protection from hazards such as moisture and static electricity.
• Wear leather gloves when working with banding materials or wooden boxes.
• Keep the area within 50 feet of ammunition clear of vegetation, refuse, empty packing materials, and other hazards that could cause a fire to spread to the ammunition.
• Keep water barrels/tubs at locations where WP/PWP ammunition is kept. These barrels/tubs are used to immerse leaking WP/PWP rounds and for first-aid for WP/PWP burns.
• Store ammunition in dugouts/depressions below ground level to reduce exposure to heat.

Unexploded ordnance (UXO)

• Remind soldiers not to touch, pick up, attempt to disarm, or otherwise disturb any UXO, dud ordnance, or any unknown object they might come across. Tell them to mark the location to warn others and report it immediately to EOD through their chain of command.
• Do not allow soldiers to collect duds for souvenirs.
• Notify adjacent units prior to EOD destroying UXO to avoid transmission of false alarms.

• Remind soldiers to—
  - Make any radio transmission at least 100 meters away from a UXO hazard.
  - Not move toward suspected UXO. Some types have magnetic or motion-sensitive fuses and will detonate when they detect a target. Other types have self-destruct timers.

Fire precautions

• Keep all flammable materials and all flame- or spark-producing devices away from ammunition and explosives. This includes matches, lighted cigarettes, petroleum products, and vehicles with leaking fluids.
• Ensure fire extinguishers are present wherever ammunition is handled, stored, or transported.
• In case of fire, evacuate the area to a distance of at least 400 meters and take cover.
• Clearly post "Add No Water" signs to ammunition containing materials such as thermite or triethyl aluminum (TEA/TPA) that react violently with water. These fires may be smothered with sand or earth.

Loading precautions

• Ensure that vehicle brakes are set, engine is turned off, and at least one wheel is chocked during loading and unloading.
• Ensure ammunition weight is evenly distributed and the load is secured to prevent movement.
• Ensure vehicles and trailers loaded with ammunition are parked at least 50 feet from vehicles and trailers loaded with flammable liquids.

Storage precautions

• Protect ammunition, particularly unpackaged ammunition, from direct sun. However, tarpaulins or other covers placed directly on ammunition could cause deterioration, so a ventilation space must be provided.
• Disperse ammunition to minimize loss in the event of fire, accidental explosion, or enemy action.
• Conform to quantity-distance standards for storage of ammunition and explosives.
• Ensure that captured ammunition and ammunition of unknown origin is examined, evaluated, and classified by qualified personnel and stored in a designated collection point.
• When storing ammunition, use sand dunes, barriers, buildings, and so forth to prevent propagation and to protect personnel and materiel from the effects of an explosion.
• Store ammunition containing white phosphorous (WP) in an upright position. (WP liquefies at high temperatures, and ballistics will be affected by horizontal storage.)

Pyrotechnics

- Ensure soldiers know that simulator flash powder ignites instantly and explosively and that simulators should not be exposed to intense heat and direct sunlight. Remind them never to cut open or hand-ignite these devices and to mark duds and seek EOD guidance for handling and disposal.
- Remind soldiers, while training, not to throw/detonate simulators, flares, or smoke devices near troops, tents, vehicles, or other flammable/combustible materials.
- Remind soldiers to roll down sleeves and wear gloves and helmets when using simulators.
- Warn soldiers not to drop or mishandle ATWESS or Hoffman-device cartridges and to roll down sleeves and use gloves and helmets when loading them.
- Ensure that all crewmembers are in vehicle when using Hoffman, and be sure to clear the rear when using ATWESS.
- Remind soldiers to beware of missile hazards when simulators are used on rocky terrain.

Maintenance

Track checks

- Ensure proper PMCS is conducted.
- Ensure that tracks are lubricated often to flush out sand-grease mixture.

Tire checks

- Ensure that tires are checked often for cuts and wear.
- Remind drivers to check for rocks between duals and to check tire pressure often.
- Be aware that the combination of sand, heat, and rough ground shortens the life of tires.

Tire repair

- Insist that mechanics always use a tire cage.
- Remind mechanics to use proper tools, to keep hands out of cage while inflating, and to use a 10-foot extension for split rims.
- Remind mechanics to use the buddy system when lifting, removing, and installing large tires.
- Ensure personnel are certified on servicing split-rims.

Batteries

- Warn soldiers to remove all rings, bracelets, wristwatches, and neck chains before working around vehicle batteries and other equipment.
- Remind personnel to keep air vents on caps clean to allow gas release and avoid pressure buildup.

• Ensure that personnel check levels often. Battery electrolyte water evaporates faster in extremely hot weather.
• Ensure that personnel adjust battery electrolyte levels during the day. (When batteries cool, levels will lower slightly and overflow will be avoided.)
• Require the use of slave cables. Only as a last resort should jumper cables be used. Remind personnel to beware of sparks as jumper cables are attached around the battery's gaseous vapors.
• Ensure that mechanics adjust voltage regulators to lowest setting possible to avoid over-charging.
• Require use of face shields, goggles, and aprons when servicing batteries.

Recovery operations
• Remind recovery personnel to use a braking vehicle when required by TM and to always use correct hookup procedures.
• Ensure that all vehicles are equipped for self-recovery as appropriate (tow ropes/cables and rope ladders, pierced steel planking, or other traction material to place under tires).
• Caution soldiers to keep hands and clothing at least 5 feet from winch when rewinding cable after recovery operations.
• Enforce safe towing speeds.
• Match driver to mission.
• Fabricate ground-support devices for outrigger support in soft soil.

Eye protection
• Require goggles for work under vehicles.
• Require that the right tool be used for every job.

POL
•Remind personnel to use extreme care when changing hot lubricants (they can burn).
• Take care to prevent sand/dust contamination of POL.

Brakes
• Remind mechanics to use low air pressure to remove sand/dust from brake-drum areas.

Radiators/coolant
• Remind personnel to use caution when removing radiator caps from hot vehicles and to check radiator fluids often to avoid overheating. (Use hand to remove cap only if cool to touch. Turn cap slowly to release pressure.)
• Remind personnel to keep radiators and airflow areas clean and free of debris to avoid rupture of radiators.
• Require that radiator caps be tested often. (Caps control radiator pressure.)

Grounding

• Ensure that portable electric power tools and power generator equipment are properly grounded (see section on grounding).

Communications

Antennas

• Remind personnel that, when erecting RC-292/OE254 antennas, they must stay *twice* the distance from power lines as the length of the antenna.
• Stress that soldiers have been killed by falling antenna-head sections.
• Require that personnel wear eye protection, head protection, and gloves when erecting antennas.
• Allow no substitutes for antenna-mast sections (camouflage poles have been a fatal alternative).
• If, for any reason, an assembled antenna-head must be left on the ground, ensure that it is guarded to prevent others from walking into it. Tip protectors are a must.

Power lines

• Identify power lines in operational areas to *all* soldiers.
• Tie down antennas when in areas of power lines (antenna tip should be no lower than 7 feet to avoid eye injuries). Use tip protectors at all times.
• Warn soldiers never to throw WD1 over power lines.

Electrical storms

• If possible, do not operate radios, telephones, switchboards.
• Disconnect electrical equipment from power sources and antennas if the situation permits.
• If equipment *must* be used, converse as little as possible. Return call after storm.

Grounding

• Ensure that *all* electrical equipment is grounded (see section below).

Grounding

General

• Remind personnel that extra care must be given to preventing static electricity in hot, dry climates.
• Ensure that personnel know that desert soil requires special grounding procedures in accordance with FM 20-31.
• Instruct personnel to dig/drive ground rods to a depth of 6 feet.
• Remind personnel to keep soil moist around grounding rods to increase conductivity and to keep ground rods, straps, and connections free of paint or oils.

Fuel handling

Grounding and bonding

- Ensure that proper grounding and bonding procedures are always used (see grounding section above).
- Remind personnel that hot, dry, dusty conditions contribute to the generation of static electricity.
- Remind personnel to ground themselves by touching a large metal object before handling fuel hoses and nozzles.
- Ensure that grounding and bonding equipment is inspected regularly.

Fuel trucks

- Remind personnel to—
  - Lubricate equipment more often.
  - Use light oil instead of grease.
  - Keep caps and covers on systems.
  - Keep pump engines clean.
  - Purge tanks, lines, and filter separators at start and end of day.
  - Recirculate all fuels to remove water.
  - Keep pressure relief valves clean (compressed air).
  - Watch for corrosion.

Fuel-system supply point

- Remind personnel to—
  - Not fill collapsible bags to full capacity (allow for expansion).
  - Leave hose line valves slightly open to allow for fuel expansion into tankage.
  - Keep pump engines clean.
  - Lubricate pumps more often.
  - Use dust caps and plugs.

Refueling operations

- Ensure proper bonding and grounding procedures are used.
- Remind personnel to—
  - Not fill vehicles to full capacity (allow for expansion).
  - Keep tank truck hatches open during refueling to allow vapors to escape.
  - Stay on the windward side to prevent being overcome by fuel vapors.
  - Close hatches immediately after refueling.
  - Use bottom-load procedures when possible. (If top loading is used, use extreme caution and start the refueling procedure at a slow rate until the level of fuel has covered the hose. Thereafter, increase the flow rate slowly.)

Protective clothing and equipment

- Remind personnel not to wear nylon clothing. (Nylon will build up electrostatic charges.)
- Remind personnel to wear fuel-resistant or rubber gloves and protective clothing to keep fuel off the skin. (Skin is highly susceptible to drying, cracking, and peeling if it comes in contact with fuel in desert conditions.)
- Coordinate with QM laundry to wash clothing with an anti-static additive to reduce static electricity.

Bivouac

Sleeping locations

- Establish a designated sleeping area. If situation permits, mark perimeter with engineer tape or chem lights.
- Post unit perimeter security personnel equipped with lights for signaling. Ensure they have been thoroughly briefed on their duties and responsibilities.
- Ensure that vehicles are not parked where they can roll toward sleeping personnel or on an incline without chocks.
- Brief all soldiers on correct driving/sleeping procedures during hours of darkness.

Dismount points

- Establish dismount points beyond which vehicles may not move without ground guides.

Ground guiding

- Require all vehicles to use ground guides, especially during darkness and other periods of reduced visibility.
- Require use of two ground guides when moving tracked vehicles within or through an assembly area at any time.
- Ensure that ground guides use NVGs when appropriate.
- Require that person in vehicle commander's position wear NVGs (if available) during ground-guiding operations at night.

Tents

- Ensure that all personnel fueling/operating tent stoves are properly trained and licensed.
- Ensure that stovepipes extend above the top of tents (spark arrestor is required) and are cleaned periodically.
- Ensure that stoves are not operated at full capacity.
- Ensure ventilation is adequate.
- Ensure operable fire extinguishers are accessible and each entrance and that operators are assigned and knowledgeable.

• Require that electrical circuits be routinely inspected for possible overload condition.
• Ensure that personnel prevent stove fuel from leaking and require immediate cleanup of any spills.
• Establish and enforce smoking areas.
• Use tent liners as added insulation from heat and cold.
• If rebar is used to stake tents, cover the stakes to protect personnel from being cut on the sharp edges. Overturned plastic water bottles are an excellent cover for the stakes.

Wind

• Ensure sufficient anchorage is provided for tents in sandy and high-wind conditions.

Mess operations

Sanitation

• Ensure all food waste is properly disposed of. If buried, do so daily and at least 30 meters from food preparation areas.
• Ensure food preparation area is at least 100 meters from latrines and 50 meters from incinerators.
• Ensure food is protected from contamination.
• Monitor food handlers and other soldiers to ensure sanitation standards are maintained.

Fire/explosion

• Ensure kitchen fuel storage area is at least 15 meters from working area and is marked as a hazard area.
• Ensure operable fire extinguishers are accessible (with designated operators) in mess-tent area and at stove-lighting and fuel-storage areas.
• Ensure all personnel fueling/operating stoves, immersion heaters, and burners are properly trained.
• Make operators aware that increased heat will add pressure to fuel tanks and fuel cans and that particular attention should be given M2 burners.
• Keep mess-tent exits clear of obstructions.

Cuts/burns

• Remind personnel to—
- Keep knives sharp, and use the right knife for the job.
- Not use knives or other sharp implements to open tray packs (use modified can opener and P38).
- Tilt heated tray packs and cans to right or left when opening to prevent burns from squirting hot juices.

Materiel handling

Load stability

•Remind soldiers that loads can shift in transit and to be particularly careful when opening conexes and other shipping containers.

Lift/carry procedures

- Enforce use of correct techniques:
  - Never carry a load heavier than can be managed with ease.
  - When in doubt, get assistance.
  - Bend from the hips and knees, not just the waist.
  - Carry heavy objects close to the body.
  - Avoid sudden movements; move slowly and deliberately.
  - Do not carry unbalanced loads.

Slips, trips, and falls

- Supervise operations.
- Ensure that areas are clear of obstructions and hazards, and remind personnel to use care when vision is obstructed by objects being carried.
- Caution personnel not to jump or step from cargo vehicles while carrying loads; tell them to use a ramp or get help.
- Remind personnel to use extreme care when carrying loads in loose sand or over rough surfaces.

Ground guiding

General

- Train drivers in the correct use of ground guides and *all personnel* in how to perform as ground guides.
- Stress importance of ground guides when traveling cross country during periods of limited visibility.
- Remind drivers to always use one or more ground guides while backing.
- Equip ground guides with suitable lights and NVGs during periods of limited visibility and darkness.

Survivability positions

Inadequately constructed survivability positions can turn into death traps. During Operation Desert Storm, three soldiers were killed and three more were injured when the bunkers they were in collapsed.

Commander's responsibility

- Protect troops.
- Improve and maintain unit survivability continuously.
- Provide materials.
- Supervise construction.
- Inspect periodically.
- Plan and select fighting-position sites.
- Get technical advice from engineers as required.

Construction tips

- Dig down as deep as possible. Don't build above ground unless absolutely necessary.
- Don't use sand or sandbags for structural support.
- Maintain, repair, and improve positions continuously.
- Inspect and test position safety daily, after heavy rain, and after receiving direct and indirect fires.
- Revet excavations in sandy soil.
- Don't drive vehicles within 6 feet of a position.
- Interlock sandbags for double-wall construction and corners.
- Don't take shortcuts.
- Check stability of wall bases. Don't forget lateral bracing on stringers.
- Don't put soldiers in marginally safe bunkers.
- Don't overfill sandbags; fill them only about three-quarters full.

Built-up positions

- Only when absolutely necessary (e.g., bedrock prevents excavation).
- Use only appropriate construction and structural material.
- Don't use sandbags as structural support (e.g., sandbag wall supporting OHC).
- Consult FM 5-103 for above-ground bunkers and shelters.

Soil considerations

- Rain, vibrations, and vehicle traffic will weaken soil.
- Maintain position by periodically inspecting revetment walls, cover, waterproofing, and slopes. If bunker walls or roofs are bowing, reinforce them or abandon them. Inspect stringers for wear, cracks, bends, and bows. Replace if necessary.
- Open excavations will not hold a side wall. They cave in and collapse.
- After an artillery barrage, test, inspect, and repair position.

Combat construction

Equipment operation

- Remind operators that construction equipment may be very unstable off road in sandy and rocky terrain.
- Ensure operators and supervisors check outriggers for stability. This is especially critical in sand or soil where a surface crust exits.
- Ensure safety belts are worn at all times when operating equipment.
- Ensure rollover protection systems are installed, and erect sun umbrellas on slow-speed equipment such as rollers and compactors.
- Establish operator/crew equipment-rollover drills.
- Ensure ground guides are used at construction sites and in congested areas and bivouac locations.
- Ensure all prime movers and trailer brake systems are fully operational on equipment haulers and other M915 series vehicles.
- Rehearse braking and downhill-driving procedures with all operators.

Construction sites

- Appoint a site safety supervisor for large earthwork or building construction sites.
- Ensure helmets or hard-hats are worn at construction sites.
- Control vehicle, pedestrian, and troop access to sites.
- When excavating, ensure excavation walls are reinforced to prevent cave-ins.
- Ensure all personnel on the site know what to do in case of flash floods.
- Ensure all electrical equipment is grounded, and ground and bond when transferring fuel (see section on grounding).
- Ensure safety equipment (goggles, gloves, welding masks, aprons, dust respirators, etc.) is available and used.
- Ensure personnel do not shortcut safety procedures due to heat discomfort.
- Ensure personnel know precautions to take during a windstorm to prevent injury and equipment damage.
- Determine if site has windstorms and ensure this hazard is taken into account during both design and construction.
- Establish policies and procedures for recovery of equipment in sand.
- Protect electrical wiring, hydraulics, and optics from abrasive effects of blowing sand.
- Protect hydraulics, fuel, and optics from sand/dust contamination.

Heat effects on tools and materials

- Ensure gloves are worn when working with metal tools and materials exposed to the sun.

• Remind personnel to—
- Take into account expansion and contraction of metal tools and materials. (Metal will contract during cool nights and expand during hot days.)
- Check wire rope rigging and bolt torque specifications to minimize varying heat stress/strain effects.
- Keep sawdust cleaned up in carpentry areas. Sawdust fires occur frequently in hot, dry climates.
- Frequently inspect wooden items such as shovels, axes, and hammers for shrinkage from extreme heat and low humidity. Check and tighten as needed.
- Protect flammables (flash point less than 100°F) and combustibles (flash point 100°F or greater) from extreme heat exposure.

• Emphasize need for spill control. Remind personnel to remove contaminated soil from operational areas at once because of extreme fire and vapor hazards in hot, dry conditions.

Combat engineer

Demolitions

• Prohibit towing MICLIC with M1 tank due to extreme heat from M1 exhaust.
• Ensure proper procedures and tools are used when working with demolitions (i.e., crimper, flak jacket, helmet, and nonsparking tools).
• Ensure that static electric charges are checked for and grounded and that anti-static laundry additives, anti-static sprays, and individual grounding are used on large metal surfaces/vehicles.
• Ensure demolitions are stored properly. Provide shade and ventilation, separate and sandbag sensitive initiation components, and protect emplaced demolitions (especially blasting caps) from direct heat.
• When blowing explosives, make sure survivable safe distance or cover is used.
• Ensure that explosives are kept away from food and eyes and that personnel clean hands after handling explosives.
• Conduct a test burn to determine local condition effects on time fuse.
• Remind personnel to crimp blasting caps before placing on explosives and not to connect blasting caps to det-cord leads until nonessential personnel are evacuated.
• Don't conduct live demolition training during electrical storms, and don't use electric caps within 155 meters of energized power lines.

Land mines

• Ensure that only the AN/PSS-11/12 mine detector is used. (The AN/PRS-7 metallic/nonmetallic mine detector should not be used, and those still on hand should be turned in immediately.)
• Enforce wear of body armor.
• Remind all personnel that—
- Sand can cause malfunctions.

- Moving sand and windstorms can cause mines to drift.
- Pressure- and tension-release anti-handling devices must have firm bases/anchors.

• Ensure that static electric charges are checked for and grounded.
• Protect stored mines and fuses from direct heat (shade and ventilate).
• When detonating land mines, make sure the proper survivable distance or cover is used.

Armor vehicle launch bridge (AVLB) Class 60-68

• Ensure all bridges used to support MLC 60-68 are inspected on a regular basis. (Catastrophic failure of AVLG is possible if safety restrictions are not enforced.)

Wire obstacles

• Ensure proper equipment is used and proper clothing is worn (barbed-wire gloves, sleeves rolled down) when constructing wire obstacles.

Rail operations

Ground guides

• Ensure training is provided to all drivers in the proper use of ground guides, and to all personnel in how to act as ground guides.
• Have ground guides escort all vehicles on and off rail cars.
• Ensure ground guides are used when backing and in congested areas—two ground guides when vision is restricted and at all times for tracked vehicles.
• Remind drivers to keep ground guides in view at all times.
• Instruct ground guides never to—
- Walk backwards.
- Be on the same rail car as a moving vehicle.
- Get between two vehicles.

Load teams

• Provide gloves and correct tools for the job.
• Provide instruction in proper use of tools. Inspect tools, blocking, lashing, spanners, and tow bars for serviceability before use.
• Require all tank turrets and howitzer tubes to be in travel lock.
• Prohibit sleeping on, in, or around rail cars.
• Remind personnel to maintain three points of contact when climbing on vehicles or other equipment.
• Remind personnel to ensure that turret rotation and gun-elevating controls are wire-tied to prevent movement.

Power lines

- Require antennas to be removed or tied down and internal equipment secured.

Drivers

- Assign only qualified drivers.

Airlift operations

Ground guides/drivers

- See rail-operations section.

General

- Check hazardous material for compatibility. Certify any potentially hazardous materials.
- Ensure that fuel and brake systems have no leaks.
- Have personnel check vehicle and fuel containers for proper levels.
- Ensure that cargo and vehicle equipment is secured to prevent movement while in flight.

Section VI

Port Operations

Pressure to ship can overwhelm shipping performance and safety standards. This section addresses areas of concern in port operations. Listed under each area are actions leaders should take to reduce the hazards.

Before departure

Preparation checklist

Use the following checklist to prepare for port operations.

- Plan on shipped items arriving well after the unit. Bring an adequate amount of supplies and repair parts with the unit.
- Start each day with a safety briefing to combat "mission-itis" and establish safety awareness.
- Establish a vehicle loading plan for sea shipment. Make sure nested vehicles (those carried in the backs of other vehicles) are included in the load plan. Include nested vehicles and blocking-and-bracing material requirements for all general cargo.
- Do not overgross prime mover carrying a nested vehicle. Make sure the automated unit equipment list (AUEL) reflects the prime carrier and its nested vehicle or built-up actual height, length, and weight.
- Always block, brace, and tie down both nested vehicles and general cargo.
- Make sure nested vehicles have all lifting shackles in place in case they must be de-nested at the port.
- Inspect shackle support and supporting vehicle structure to make sure it is in good shape and that welds on shackle bracket are sound.
- Check each vehicle for condition of all lifting shackles, proper size of shackle, and proper size of shackle pin and cotter key.
- Always carry extra shackles for unit vehicles. (Shackles often disappear, and, without shackles, the vehicle may not be shipped.)
- Identify lifting shackles by painting the world "LIFT" next to them. Paint "TIEDOWN ONLY" next to tiedown shackles.
- Establish ammunition turn-in procedures and enforce penalties for violations.
- Turn in all ammo and munitions.
- Check each vehicle for loose rounds or pyrotechnics and for munitions tucked into storage compartments.
- Check pack pockets and gear pockets for loose rounds; turn them in.

• Inspect unit gear to ensure no ammunition or other explosive is inadvertently packed away.
• Establish standard for inspections and retention of war souvenirs.
• Inspect each war souvenir for hazards and Department of Agriculture appropriateness.
• Check for critters in unit gear.
• Identify "sensitive class" unit cargo and make sure AUEL reflects this status.
• Identify hazardous classes of cargo, and eliminate compatibility problems. Make sure AUEL accurately reflects which vehicles contain sensitive or hazardous cargo.
• Do not leave loose items in vehicle cabs. During a long, rough sea voyage, items could beat themselves and the inside of the vehicle to pieces.
• Be mindful that vehicles might be transported on deck and not down in a dry hold. The best check is to ask, "If this vehicle were under a constant stream of sea water, would my load plan still be okay?"
• Block and brace equipment in the back of trucks to the maximum extent possible. Ship ramps sometimes exceed 45 degrees. Loose gear will tumble out.
• Tie down, block, and brace all cargo. A sea voyage is twice as rough as a road march, so don't pack for a road march.
• Use plastic to wrap radios in racks inside vehicles and tracks.
• Adjust vehicle fuel loads so that vehicles arrive at port with tanks no more than three-quarters full. Always check with the departure port Army terminal unit for the latest in-country standards for fuel-tank levels and 5-gallon fuel-can levels. Drain fuel from generator sets before packing.
• If fuel tankers must be purged, make sure that all hoses are also drained.
• Do not drain POL tanks and hoses onto ground. Use proper fuel drain cans and dispose of drainings per unit SOP.
• Ensure that vehicles containing compressed-gas cylinders (other than a fire extinguisher) are placarded on both sides of the vehicle with standard hazardous-cargo placards (available from division/corps transportation officer).
• Remove oxygen and acetylene cylinders from wreckers and maintenance vehicles. Build bottle racks in a trailer, and secure all battalion acetylene bottles in the racks. *Caution: do not overgross the trailer.* Stencil unit designation on each bottle, and properly placard the trailer.
• Make sure gas cylinder bottles have caps and that caps are secured.
• Inspect all vehicles for fuel, oil, and other leaks. Correct them.
• Ensure that any vehicle with a brake problem has a big steering-wheel placard stating, "CAUTION, NO BRAKES. DO NOT DRIVE. MOVE WITH TOW BAR ONLY."
• At the start of each day, go over standard ground-guide safety procedures and hand and arm signals. Stress ground guide use in the motor pool and vehicle preparation areas.
• Ensure drinking water is available in vehicle-preparation areas.

Movement to port

Movement liaison team

Experience during deployment shows that the transition from field to port is more effectively accomplished if a liaison team is created to perform the following functions:

- Ensure the safe and timely processing of unit assets from field assembly areas through marshaling areas to the port in accordance with the port-call message. Allow for adequate driver rest.
- Set the tone for the move by emphasizing the commander's safety standards at each phase of the movement sequence.
- Perform risk assessment of movement operations, and present command group with options to eliminate movement-to-port risks.
- Provide a single point of contact for all safety and operational questions concerning equipment preparation standards for sea shipment.
- Maintain liaison with port operating elements regarding equipment preparation, U.S. Customs, Department of Agriculture standards, and the port-call message.
- Resolve movement-to-port problems before departure to port.
- Provide a seaport element to make final vehicle shipment decisions. For example, with one space left on the ship, do you send the A Company or the B Company vehicle?
- Keep the command group and participating units informed.
- Establish controlled environments in which soldiers are cared for and accounted for from start point through their time at the seaport of debarkation (SPOD).
- Maintain unit integrity of personnel at SPOD.
- Organize maintenance assets to assist Port Support Activity (PSA) in fixing vehicles in the marshaling and port areas to ensure serviceability and readiness for sea shipment.
- Movement liaison team will consist of a team leader, an assistant team leader, an NCOIC, and an administrative NCO.
- Movement liaison team will require—
  - Hand-held brick-style radios.
  - Secure fax.
  - Published FM frequency.
  - Dedicated utility helicopter reserved for maintenance/parts flights or command and control missions.
- Liaison team leader should be located at assembly area during vehicle preparation and at the port during the movement-to-port phase. The team should develop a marshaling-area plan that covers—
  - Receiving convoys.
  - Refueling and/or defueling vehicles to Coast Guard limit. Arrange for excess fuel storage.

- Performing unit/direct support maintenance before staging.
- Providing final technical inspection to ensure that all vehicles are ready for sea shipment.
- Pre-staging vehicles by unit or by type.
- Messing and sleeping areas as required.
- Latrine facilities.
- Administrative support.
- Personnel control so the area does not become a giant parts/supply opportunity.
- Quick spot-check by port personnel of vehicle preparation and LOGMARS (logistics applications of marking and reading symbols) labels to make sure that if any last-minute problems are found, they can be corrected in the assembly or marshaling area.

Arrival at port

Seaports are traditionally busy, congested, and confusing places. As the unit's vehicles arrive at the seaport, port personnel will give them a quick visual inspection to identify those with obvious problems. The LOGMARS label will be scanned, and all hazardous and sensitive cargo will be separated out of the main vehicle flow and sent to hazardous- and sensitive-vehicle staging areas. The remaining vehicles will be sent to other vehicle staging areas, where port personnel will again check vehicles and scan LOGMARS labels. Drivers and assistant drivers will be sent out of the staging areas to an assembly area for transport off terminal.

It is important that vehicles arrive precisely at the time specified in the port-call message and that everyone know what to do upon arrival. The following checklists should help.

Leader checklist

- Carry enough water for your troops. Estimate one day on terminal, although actual time should be less.
- Explain the unit's terminal control plan to the driving and supervisory teams, to include—
  - Where drivers and other unit personnel should assemble after parking their vehicles.
  - Water-point location.
  - Latrine locations.
  - Trash-can locations for MRE packages, etc.
- Stress unit integrity, NCO control, "don't wander around" philosophy.
- Unit key-control officer must make prior coordination with port operators on availability and location of key-control NCO/officer. If possible, get a radio from Transportation Terminal Unit to ensure common communications and quick response by key-control team.

• Explain how troops will depart the terminal and when and where they will be transported.
• Have a final check team go through the unit's vehicles after all the troops are assembled to check for mistakes, oversights, items left behind, shackles, lights or radios left on, etc.
• Before departing the terminal, perform a roll call accountability check.
• Allow only essential personnel to enter staging areas while staging areas are filling.
• Do not allow drivers to fill out forms in vehicle staging areas during in-flow of vehicles. Doing so keeps drivers and assistant drivers in these areas while port personnel are trying to flow cargo rapidly into the same area. This mass of troops presents both a safety and a control problem.
• Do not plan to do nesting at the port. Any nesting should be accomplished at the assembly area in the field or at the marshaling area.
• Milvans and conexes must be certified as either hazardous or nonhazardous. This is usually done at the pack-out in the assembly area, where the certifications are put on the conexes and milvans. En route to the port, the certifications sometimes blow off. So have the unit transportation officer/NCO at port to replace certificates. Otherwise, port personnel will have to open the conex/milvan to determine its classification.
• Personnel who will go aboard the ship during the load-out will need the following equipment.
  - Pre-boarding ship-safety briefing.
  - Helmet or hard-hat.
  - Hearing protection (earmuffs or earplugs).
  - Canteen.

Driver checklist
• Keep an alert heads-up focus.
• Turn on driving lights in terminal.
• Use ground guide for all tracked vehicles and when backing vehicles 2½ tons and larger and any other vehicles in which visibility dictates the need. Ground guides should not walk backwards when guiding any vehicle.
• Keep proper distances between vehicles.
• Keep vehicles free from hanging materials such as chains or ropes that could snag on a cleat or tiedown fitting and yank cargo off a truck.
• Report vehicles with maintenance problems to port reception personnel.
• Secure radio whip antennas upon entering terminal. Remove antennas from tracked vehicles and store inside hull.
• Put main gun of tanks and fighting vehicles in travel lock position.
• Obey terminal speed limit (normally 15 mph, or about the speed of a brisk walk).
• Don't leave personal or military items in your vehicle.
• Anything left in the vehicle cab should be wrapped, blocked, and braced. Make sure vehicle windows are rolled up.
• Make sure all vehicle locks are locked.

- When driving in the vicinity of the port helipad—
  - Remember, aircraft have right of way.
  - Make sure your antenna is down.
  - Look for ground direction from air traffic control (ATC) personnel.
  - Proceed only when ATC personnel wave you forward.
  - Dim your lights.

Section VII

Accident Reporting

The "minor" accident in your unit may seem unimportant; however, added to others Armywide, it may help to identify a trend. Trend identification is essential to analyzing accidents in order to develop programs to protect soldiers and equipment.

The Army Safety Center needs to know about accidents that happen in your unit; your accident reporting to your chain of command is crucial to our ability to help soldiers operate safely. Report all accidents as per chapter 3, AR 385-40: *Accident Reporting and Records,* dated 1 November 1994.

The commander who first becomes aware of any Class A or B Army avation or ground accident, or Class C Army aviation accident (flight, flight-related, or aircraft-ground) will, through the existing chain of command, immediately notify the immediate commander of personnel involved and the U.S. Army Safety Center (DSN 558-2660/3410, commercial 334-255-2660/3410).

Peacetime

Ground-accident reports will provide, at a minimum, the information required for DA Form 7305-R: *Worksheet for Telephonic Notification of Ground Accidents.* Aviation-accident reports require the information on DA Form 7306-R: *Worksheet for Notification of Aviation Accidents*. These reproducible forms are in the back of AR 385-40.

Ground Class C and D accidents will be reported using the DA Form 285-AB-R: *Abbreviated Ground Accident Report* (AGAR) within 30 calendar days of accident occurrence.

Aviation Class D accidents and Class E and F (engine foreign-object-damage (FOD)) incidents will be reported using DA Form 2397-AB-R: *Abbreviated Aviation Accident Report* (AAAR) within 10 calendar days of accident occurrence. No follow-up is required unless new information is discovered that—

- Relates to either safety of use or safety of flight.
- Changes the accident classification.
- Significantly changes the information already submitted.

Combat

Initial notification requirements for reporting accidents during combat operations remain the same as for peacetime. However, when the senior tactical commander determines that the situation, conditions, and/or time does not permit normal peacetime investigation and reporting, the following reporting criteria can apply.

Aviation Class A and B accidents can be reported by use of the AAAR, and Ground A through D accidents can be reported through use of the AGAR (table E-1, AR 385-40).

Accident classification

Detailed guidance regarding accident classification is provided in chapter 2-2, AR 385-40. A quick synopsis is as follows:

- **Class A:** More than $1,000,000 damage, specified equipment destroyed, a fatality, or a permanent total disability.
- **Class B:** $200,000 to $999,999 damage, a permanent partial disability, or five or more personnel hospitalized for the same incident.
- **Class C:** $10,000 to $199,000 damage or a nonfatal injury or illness causing loss of time from work.
- **Class D:** $2,000 to $9,999 damage.
- **Class E:** Less than $2,000 damage.
- **Class F (engine FOD):** Recordable damage to aircraft turbine engine (does not include auxiliary power units (APUs).

Appendix

A Lesson in Risk Management and Crew Endurance

Stress, fatigue, lack of sleep, and changing schedules have always been critical issues in the Army. But they become even more critical when working environments and schedules change with little notice or time to adjust as we deploy back and forth across time zones. In addition, the sophistication of today's equipment requires more alertness and concentration. These factors combine to make crew-endurance issues more important than ever before in both ground and aviation operations.

The biological clock

Our biological clock regulates the availability of our mental and physical resources, which fluctuate during the 24-hour day. The best and worst times of day are determined mostly by light cues received by the body clock. Exposure to daylight after a normal night's sleep sets the body clock in a day-oriented pattern, which means that physical and mental energy peaks between 0800 and 1200, decays slightly between 1300 and 1500, increases between 1500 and 2100, and finally declines from 2200 through 0600.

Inconsistency in daylight exposure times will result in unpredictable availability of alertness and energy. If wake-up times and daylight exposure vary continuously from day to day, the body clock receives inputs similar to frequent travel across time zones. Unstable sleep wake schedules, whether caused by changes in work schedules or travel across time zones, may disrupt body-clock timing and ultimately induce *circadian desynchronosis.*

Circadian desynchronosis causes classic symptoms of jet lag and shift lag, including fatigue, malaise, sleepiness, digestive disorders, confusion, and lack of motivation. These body-clock disruptions increase mission risk levels and can compromise safety if risks are not managed. Working the five-step risk-management process offers a simple way to control the risks.

The risk-management process

Step 1: Identify the hazard

It's usually easy to predict shift lag or jet lag. Anytime the work schedule and sleep/wake cycle are shifted suddenly, soldiers will be at risk for circadian desynchronosis. Given sufficient notice, leaders and individuals can take measures to minimize the effects of this body-clock disruption.

Circadian desynchronosis can be detected by a variety of signs. However, most of these signs are also characteristic of simple fatigue, so it is important to consider the context of the situation and recent body-clock history of individuals involved. For example, the following may be present in soldiers suffering from circadian desynchronosis, with or without simple fatigue:

- Vacant stare.
- Glazed eyes.
- Pale skin.
- Body swaying upon standing.
- Walking into objects.
- Degraded personal hygiene.
- Loss of concentration during briefings.
- Slurred speech.

Step 2: Assess the hazard

Gauging the severity of circadian desynchronosis depends largely on the operational scenario. For example, a sudden change of eight time zones is obviously of more concern than a long-planned trip across three. Factors such as the severity of and soldier susceptibility to desynchronosis can assist in assessing the magnitude of the hazard.

Leaders should consider the following factors when planning changes in work schedules:

- Rotations from daytime to nighttime or early morning duty hours will result in some degree of sleep loss and fatigue the first day. Controls should be implemented from the beginning of the work-schedule change.
- Night shifts ending around sunrise will pose the greatest challenge to the body clock and are associated with more severe desynchronosis.
- Rotations from daytime duty hours to afternoon or evening work schedules do not require rapid adjustment of the body clock. These rotations can be considered benign compared to rotations into night or early-morning duty hours.
- Return to daytime duty hours after several days or weeks of nighttime or early morning duty hours produces significant desynchronosis and should not be underestimated. At least 3 days are required to rotate from nighttime to daytime duty hours.

• Eastward or westward travel across more than one time zone will result in some degree of jet lag. This may manifest as fatigue in the early night for westward travelers and reductions in total sleep duration for eastward travelers. Increasing the number of time zones crossed increases the severity of symptoms.

Individual differences make some people more susceptible to jet lag or shift lag than others. It may be useful to consider the following tendencies in shift assignments and specific missions:

• People who prefer early-morning rise times (0400-0600) and early bedtimes (2000-2100) tend to adjust easily to early-morning duty hours. In contrast, those who prefer to retire at 2200 or later and rise after 0700 tend to adjust more easily to nighttime duty hours. Preferences are often masked by work schedules, so they are not easy to detect. It may be useful to determine preferred off-day bedtimes and rise times.

• Soldiers over 40 may experience sleep disturbances and gastrointestinal disorders more frequently than younger soldiers. Controls are required for all soldiers, although younger soldiers tend to benefit more quickly than the over-40 group.

Once circadian desynchronosis has developed, it is difficult to treat. To estimate the magnitude of a body-clock problem, consider the soldier's body-clock history, the severity of the signs and symptoms previously listed, and the following factors that may affect safety:

• **Impaired self-observation**. Desynchronosis is usually accompanied by severe sleep loss, with an attendant fatigue-related inability to adequately judge one's own behavior. For example, aviation crewmembers may not be able to reliably determine if they are safe to fly and may not respond to subtle warning remarks made by peers.

• **Impaired communication**. Soldiers suffering from desynchronosis may have difficulty communicating critical mission or safety information. Conversation may become fragmented and contain repetitive phrases and ideas. In addition, weariness tends to result in misinterpretation of verbal communications.

• **Increased irritability.** Irritability and impatience are commonly experienced in association with desynchronosis. One positive aspect of increased arguing is that it shows soldiers are still talking to each other, exchanging orders and messages. Cessation of bickering may indicate mental exhaustion. This is particularly dangerous between 0400 and 0700. During this period, soldiers may experience sleepiness and degraded alertness, and cognitive function will be at its lowest. The combination of acute fatigue and desynchronosis can be lethal.

• **Physical exertion.** The perception of exertion changes as a function of time of day. Desynchronosis can interfere with soldiers' ability to judge the physical difficulty of a task.

Step 3: Develop controls

The timing of sleep is critical to managing and preventing desynchronosis. Maintaining consistent schedules that ensure well-timed sleep is essential but can be difficult in the operational setting. Once shift lag or jet lag actually develops,

returning to normal can take several weeks of a consistent sleep/wake schedule. Desynchronosis symptoms are unlikely to disappear in just a few days of normal sleep. The following controls can be helpful in preventing circadian desynchronosis:

- **Napping.** In the context of body-clock adjustment, naps are recommended if soldiers rotate from day to night shift, if they cannot sleep more than 4 to 5 hours during the sleep period, and if the next night is going to be another work period.
- **Pre-adaptation.** Before deployment, a unit can attempt to pre-adapt to the new work shift or destination time zone. While potentially useful, pre-adaptation requires much coordination and cooperation from all levels of the involved unit. In a pre-adaptation scenario, deploying elements typically begin shifting their sleep/wake cycle toward the new cycle several days before transition.
- **Timed light exposure.** The timing of daylight exposure is critical for resynchronizing the body's biological clock. By carefully scheduling exposure to sunlight or proper artificial light, it is possible to speed adaptation to a new work schedule or time zone. However, incorrect timing of light exposure can actually worsen jet lag.

The following aviation example illustrates the control-development step of the risk-management process:

A mission is received that will require UH-60 crews to fly nightly troop lifts to forward combat positions for approximately 2 weeks beginning that night. Mission durations vary, with some missions ending between 0100 and 0300 and others ending between 0500 and 0600. Crews will be assigned to missions randomly, so it is difficult to assure the same schedule from night to night. The tasking will require soldiers to work a full daytime duty day on the first day.

Here's what planners came up with to reduce the effects of shifting to the night schedule:

- Soldiers working the night shift will be required to nap between 1800 and 1930 during the first 3 days of the transition. Naps will improve alertness during the night, but crews should, if possible, avoid flying the early morning hours (0300-0700) on the first day of the rotation. Leaders will need to be sure that meals are available at times that will not interfere with the napping schedule.
- To orient the body clock to a nighttime work cycle, sleep should begin as close to 0400 as possible, even if flying is completed before that. Every effort should be made to begin sleep well before sunrise to avoid exposure to daylight. Daylight exposure should be delayed until 1200. Soldiers will wear dark sunglasses to reduce sunlight exposure when it cannot be avoided.
- Exposure to bright light between 2000 and 0300 could improve adaptation to this schedule. Therefore, bright lights will be used in the tactical operations center, maintenance shops, and other areas where soldiers are required to work nighttime hours. (Note: This would not be recommended for flight crews or drivers because of night-vision impairment.)
- Soldiers working the night shift will eat breakfast upon awakening. This means breakfast must be served in the early afternoon.
- Soldiers working the night shift will be required to wear sleep masks during their sleep period to avoid inadvertent exposure to daylight.

• All briefings, maintenance, and training will be scheduled to take place outside the designated sleep period.
• The sleep period will be protected from noise by using power generators to mask sound. Commercially available sound-masking devices may also be used. Earplugs provide an alternative, and combining their use with sound-masking may be most effective.

Steps 4-5: Implement controls & supervise
The commander and planners have now identified controls to mitigate the risk. The implementation measure best used in this example would be to insert the control measures into the operations order. Supervision in the form of spot checks would ensure that the controls are followed.

Summary

Soldiers are only human. Therefore, Army leaders must clearly understand how human-endurance limitations can degrade human performance, which, in turn, can jeopardize both the safety of their soldiers and combat readiness. It's also critical that leaders understand how they can use the five-step risk-management process to control the risks.